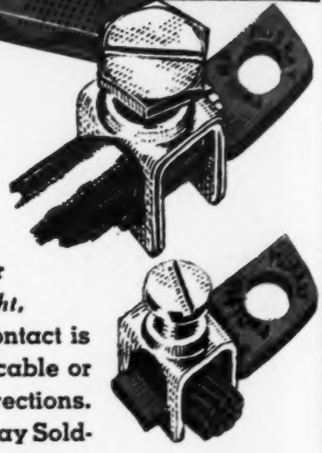
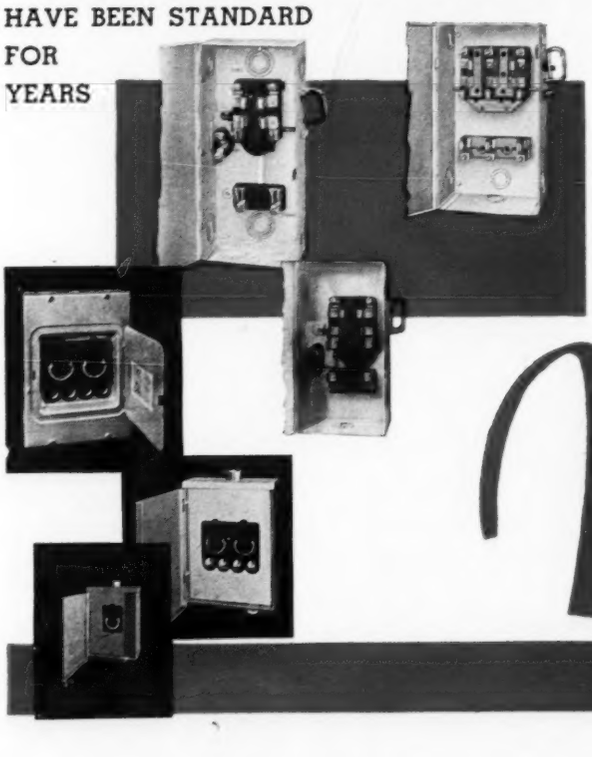
SOLDERLESS CONNECTORS THAT HOLD LIKE A VISE!

½" socket wrench for 3 larger sizes
Enormous pressure makes electrical contact absolute
Cable or wire can be inserted from any of 3 directions

FROM YOUR JOBBER — HE HAS THEM IN CONVENIENT, ECONOMY PACKAGES!



SOME FAMED MURRAY SWITCHES IN WHICH MURRAY SOLDERLESS CONNECTORS HAVE BEEN STANDARD FOR YEARS



So strong that they'll take all the tightening you will ever give them. When they're *tight*, they HOLD—and electrical contact is absolute. You can insert the cable or wire from any of *three* directions. These speedily-installed Murray Solderless Connectors have been standard in Murray Switches for years. Metropolitan Device Corporation, Brooklyn, N. Y.

SOLDERLESS CONNECTORS *by* Murray

METROPOLITAN DEVICE CORP. Brooklyn, N.Y.

Send price sheet and complete listing of Solderless Connectors

Name_____

Address_____

Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 69 YEARS

March 18, 1944 — Vol. 121, No. 12

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To .....

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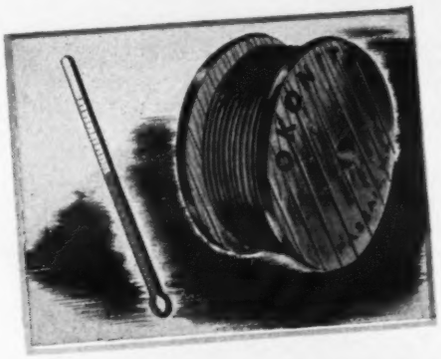
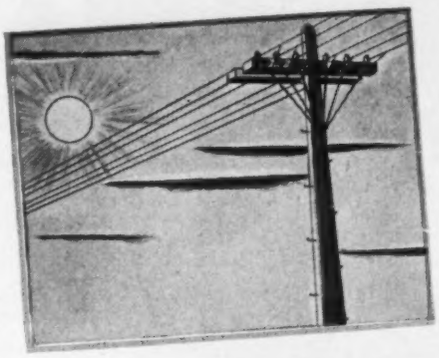
Signed .....

HOW TO PROTECT WIRES AND CABLES FROM THEIR ENEMY—HEAT

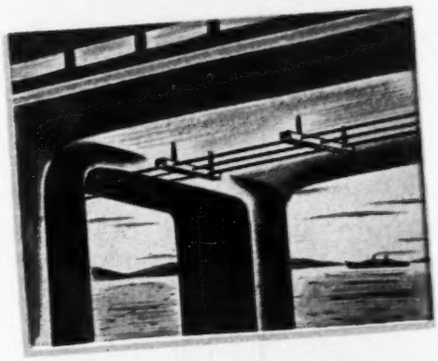
Heat is a serious threat to the long life and efficiency of electrical wires and cables, destroying covers and insulation on the reel and on the job. Yet a few simple precautions can go far to extend the life of the cable or wire. In operation, the more you reduce the temperature of the surrounding air, the longer insulation will last with the same conductor load. Or, if necessary, more current can be carried in the same cable without shortening its life. Here are some suggestions that will pay well:



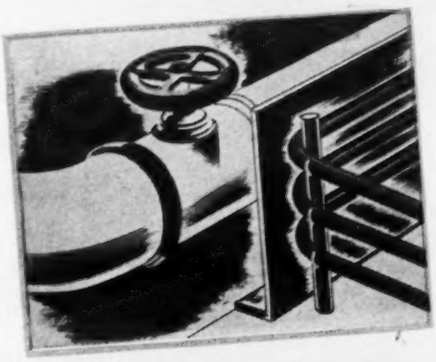
STORE CABLES IN A COOL — NOT COLD — PLACE. Stored in a cool, uniform temperature, cable insulation is maintained in the best condition for the longest possible life. Avoid extreme temperatures. Keep cables under cover.



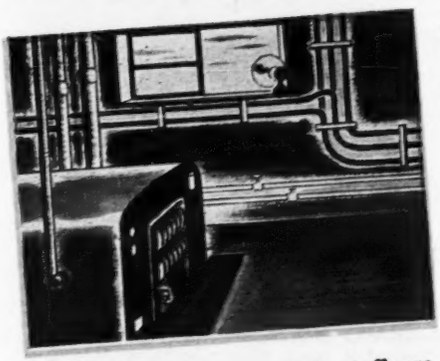
INSTALL RISER CABLES ON THE NORTH or most shaded side of poles — away from the heat of the sun.



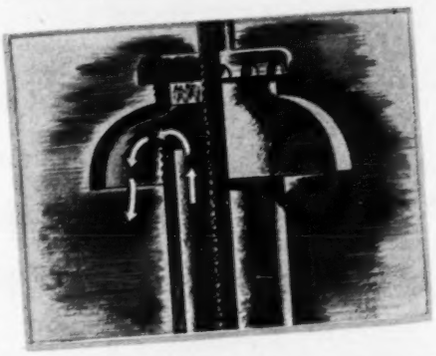
ON BRIDGES, VIADUCTS, ETC., PLACE CABLES BELOW THE STRUCTURE for protection from sun and weather. This also is more likely to add protection against accidental mechanical damage, vandalism and sabotage.



NEAR HEATING UNITS or hot pipes, move the wiring or insert baffles between the source of heat and the cables to deflect hot air.



IN HOT LOCATIONS—cut air vents in the ceiling or partition above cables to provide adequate circulation by means of natural convection or install fans.



VENTILATE POLE RISER CONDUITS and create circulation by making openings near the top or by leaving space between the conduit and pothead. This can improve the efficiency of an entire circuit.

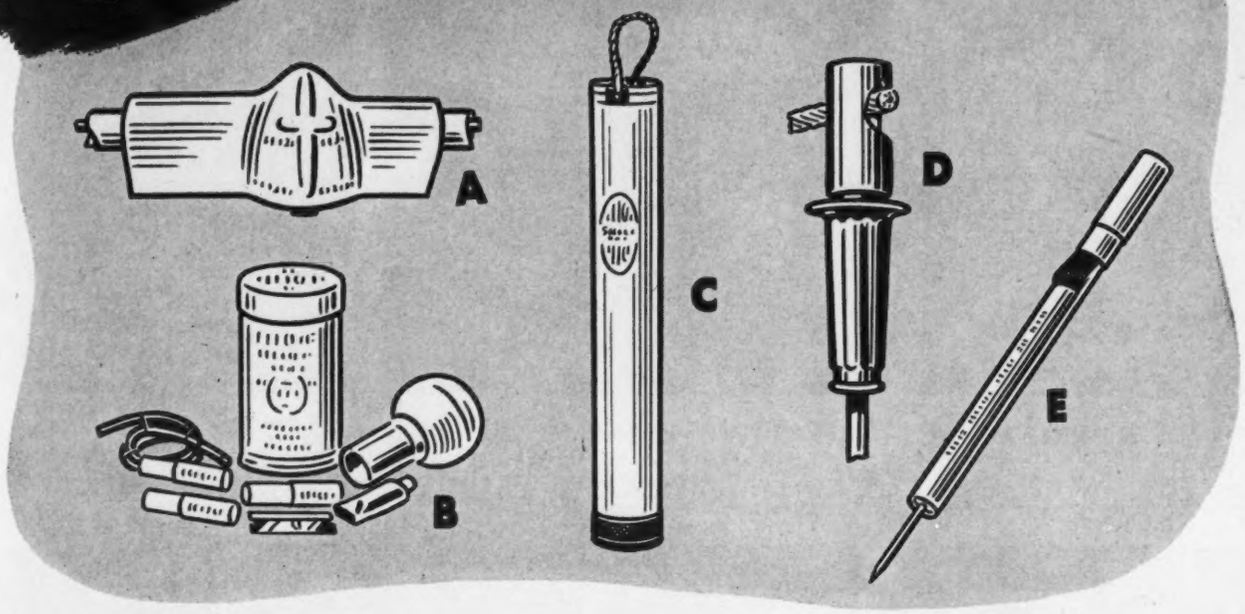
Our engineers and research staff are anxious to help you prolong cable life. We will be glad to answer questions which may help you solve problems concerning protection and longer use of your electric wires and cables. No obligation is incurred by this service. The Okonite Company, Passaic, New Jersey.

OKONITE

Insulated Wires and Cables

3587

Quiz: *Can you identify these aids to* EXTRA SAFETY *for your linemen?*



To Increase Safety—To Encourage Efficiency
Make GRAYBAR Your Pole-Line Supply Base

As part of its all-inclusive supply service on pole-line equipment and materials, GRAYBAR furnishes all the specialized safety items for hot-line work or other emergency maintenance.

Equally important to safety, however, is the sound design and workmanship of GRAYBAR-distributed tools—tools intended for the special demands which linemen make of them. Similarly, the line supplies themselves—poles, wire, insulators—give an extra assurance against difficulty and danger, because of GRAYBAR'S experience in choosing sound products, produced by suppliers of high reputation.

You aid safety and encourage efficiency when your crews are supplied by men who know pole-line requirements "from the top of the pole to the bottom of the hole". For war-essential maintenance today, for postwar construction ahead, look to your GRAYBAR Man for line supplies.

3509

Here are the ANSWERS (INVERT PAGE)

A — Insulator Hood — Used in conjunction with safety line hose to cover tie-wires and conductors as they pass insulators. Self-locking to under side of insulator.

B — Snake Bite Kit — For effective first aid often vitally needed in rural line work. Various kit combinations include suction syringe, ammonia, iodine, tourniquet and other necessities.

C — Line Hose Bag — A convenient carrier for raising safety line-hose up the pole. Holds several lengths in convenient position for placement.

D — Insulated Jumper Clamp — Equipped with 5,000-volt rubber covered flexible cable, strong, well-insulated handle.

E — Flare Light — For emergency illumination or warning use. Has spike point and friction cap ignition.

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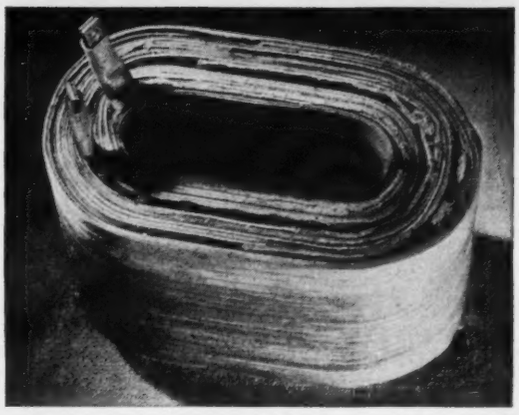
Executive Offices: GRAYBAR BUILDING, NEW YORK 17, N. Y.

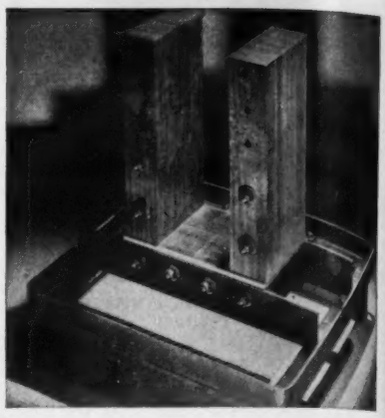
GRAYBAR 75 YEARS OF *Electrical Distribution*

GET FINER AND FASTER A. C. WELDING WITH AMPAC "400"

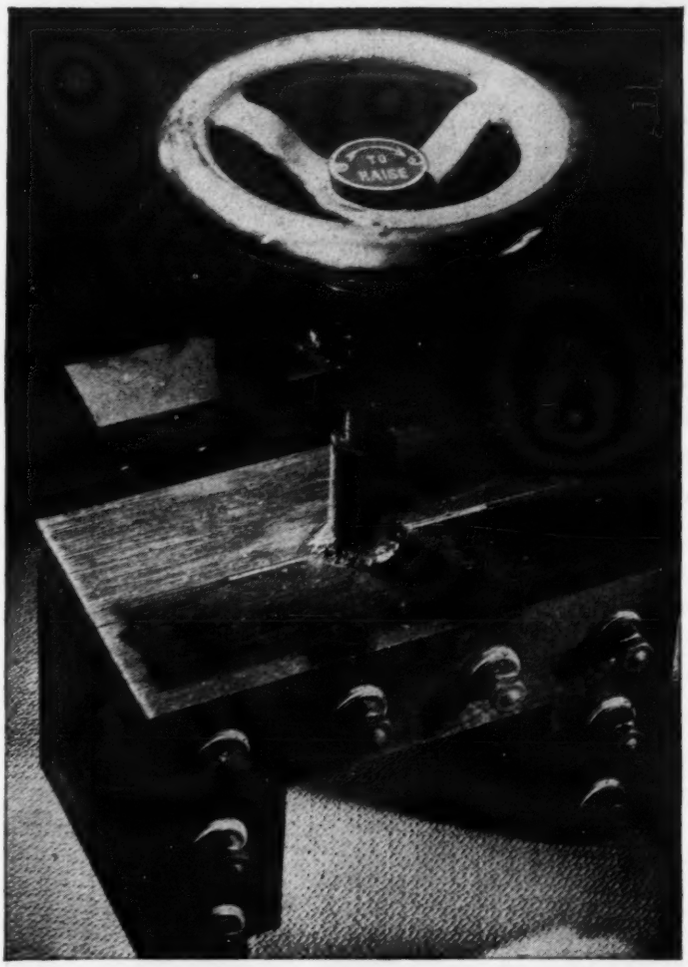
1 Revolutionary new patented circuit *increases* efficiency — *cuts* idling loss! Entire construction is *simple, rugged!*



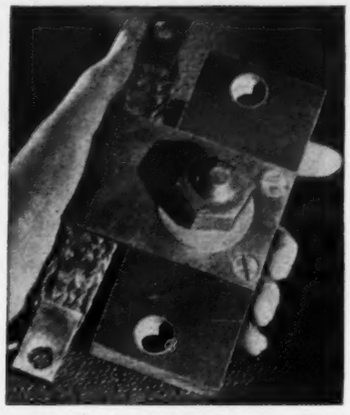
2 Transformer coil uses *rectangular* copper — glass-insulated — with primary over secondary. Air duct between windings dissipates heat — *prevents* breakdown!



3 Sturdy lower core is 1-piece, U-shaped . . . of die-punched silicon steel. Insures quiet operation . . . with *no* power-wasting air gaps!



6 Power regulation is *smooth — quick — simple!* One-inch movement of upper core covers entire welding range — 50 to 500 amps — in *seven turns* of control wheel. Cuts adjustment time to *minimum.* Speeds welding! A 1677



4 Here's typical Ampac quality — a big, tough, *extra heavy* welding terminal. Note *brazed* connections!

5 Hardened brass guide is simple, fool-proof! Channel shape provides *extra* strength.

GET COMPLETE FACTS on this brilliantly engineered a.c. welder from your nearby Ampac dealer or Allis-Chalmers district office. Ask for bulletin B6302. For data on new Ampac "200" welder, ask for bulletin B6241.

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MILWAUKEE, WISCONSIN

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2. **EXPERIENCE** - - a qualification of R&IE engineers through the application of proven designs for every type of service for many years. These R&IE engineers are equipped to solve your problem in every size and capacity.

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Small Standard braided flexes

R&IE

Flexible COPPER CONNECTIONS

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- CONDUCTOR SUPPORTS CLAMPS AND FITTING
- DISCONNECTING SWITCHE INDOOR AND OUTDOOR
- AIR BREAK SWITCHE
- INTERRUPTER SWITCHE
- CUTOUTS AND THERMO-RUPTERS
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- METAL CUBICLE
- TESTING DEVICE

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IN CANADA—EASTERN POWER DEVICES, LIMITED, TORONTO

Treadmill for 150 "Horses"

THAT'S WHAT that 150 hp synchronous motor armature is — a treadmill. Visualize 150 horses "kicking" it around at 1200 rpm. It receives *terrific* forces!

Yet that Allis-Chalmers "Indestructible" Rotor swinging over for assembly with its stator is more than able to take such punishment.

Field coils have been wound *directly* on poles . . . special clamps been installed on coils to prevent distortion . . . 1001 precautions been taken so that every detail and dimension of the rotor is *right.*

No machines exist that can do *all* those jobs; no machines are known that can factory-test how well and truly Allis-Chalmers workmen did them. There's only one test . . . wait 5, 10, 15 years — and *see.*

And that's the test that has made Allis-Chalmers motors a by-word of industry: *"You can depend on Allis-Chalmers Motors!"*

Yes, the most important thing about that rotor — more important even than Allis-Chalmers' advanced engineering and manufacturing procedure—is that *it was built by men at our Norwood Works who know they have a big personal stake in every Allis-Chalmers motor.*

They know that when they build great motors for you, they're making *friends* . . . and that no company and its employes can have too many of them! ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN.

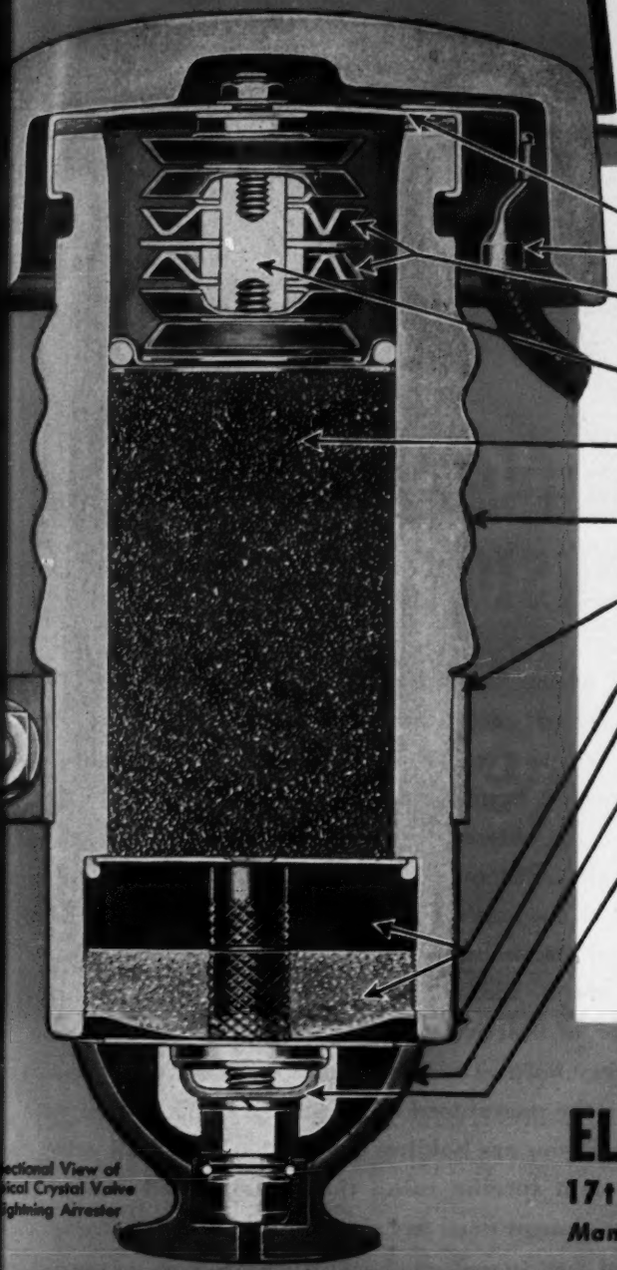
A 1713

Tune in the Boston Symphony, Blue Network, every Saturday at 8:30 pm, EWT.

YOU CAN DEPEND ON ALLIS-CHALMERS MOTORS

IMPORTANT FEATURES OF CRYSTAL VALVE CONSTRUCTION

···RESULT IN ARRESTERS GIVING YOU



ectional View of
ical Crystal Valve
ightning Arrester

1 Gasketed Copper Sealing Cover.

2 Line Lead Moisture Shield.

3 High-Speed Multi-Gap Spark Gap Structure.

4 Accurately Ground Steatite Spacers and Support.

5 Oxidized Silicon Carbide Valve Element.

6 Wet Process Porcelain Body and Cap.

7 Many Types of Mounting Brackets.

8 Duplex Ground Seals.

9 Drip Petticoats on Cap and Body.

10 Removable Cover With Snap-On Lock.

11 Perfected Ground Wire Clamp.

12 Our Experience of More Than 50 Years in the Manufacture of Lightning Arresters.

★ *Superior Protection* to equipment and service. 3, 4, 5

★ *Heavy Duty* high surge discharge capacity. 3, 5

★ *High Speed* low impulse breakdown voltage. 3

★ *Low IR Drop*—surge voltage reduction. 5

★ *True Valve Action* for follow current interruption. 5

★ *Moisture Proofness.* 1, 2, 6, 8, 9, 12

★ *Low Radio Influence* voltage level. 1, 2, 6, 8, 9, 12

★ *Rugged Construction.* 12

★ *Small Size* and light weight. 12

★ *Ease of Installation* and inspection. 7, 10, 11

★ *Low Maintenance* and long life. 12

★ All definitely proven during past twenty years. 12

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Manufacturers of Lightning Arresters for Over Fifty Years

CRYSTAL VALVE

Lightning Arresters

YOU KNOW WHAT YOU'VE GOT...

...WHEN YOU USE O-B SUSPENSION INSULATORS

IT'S EASY to be fooled by the arithmetic of insulator strength. On paper we can average the strength of individual units in a suspension insulator string and come out with an impressive figure--that won't work! Obviously, the weakest unit is the only sensible basis on which to compute a string's strength...But only recently has this sensible value been applied to suspension insulators. It started when O-B had developed its manufacturing controls to such a high degree that old-time ideas of average strength could be abandoned in favor of individual minimum strength ratings that applied to *every unit*...Today, you can see cast permanently into every cap the guaranteed minimum strength of that particular O-B unit you are holding in your hand, and all others like it. This is a specific value that can be used safely in design. You no longer need pay a premium for more strength than you need, just in order to be a little more sure of getting enough...When you build with O-B suspension insulators, you know exactly what you've got. They give you the kind of strength that *counts*, because you can *count* on it!

2470-H

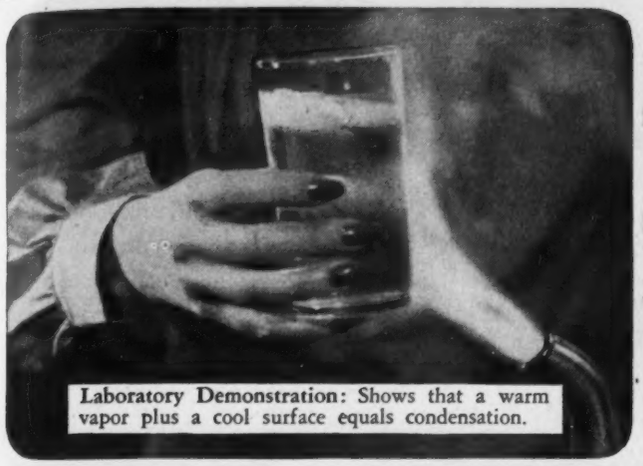
Ohio Brass

MANSFIELD, OHIO

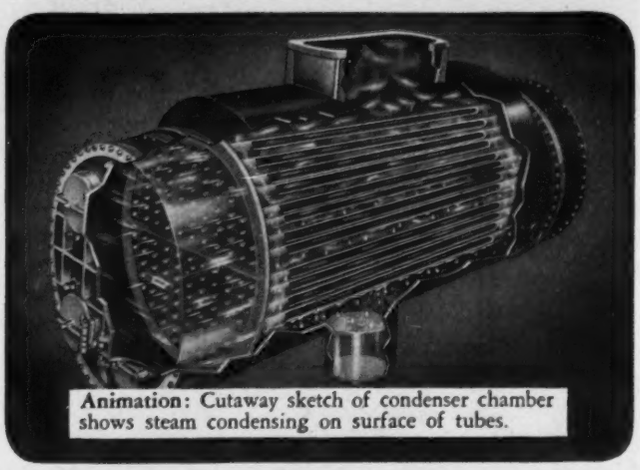
CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONTARIO

NEW MOVIE SHOWS WHAT HAPPENS

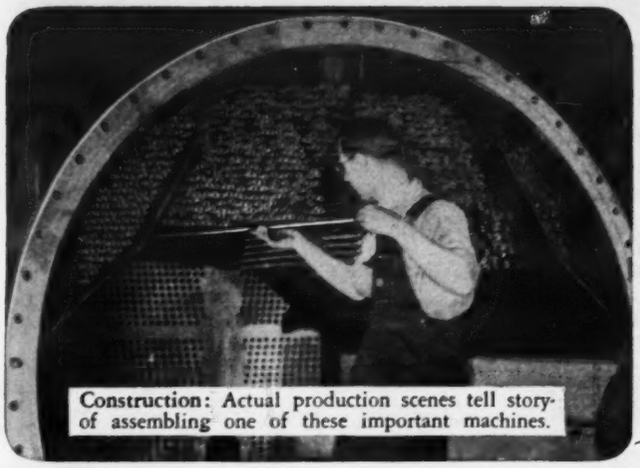
INSIDE A SURFACE CONDENSER



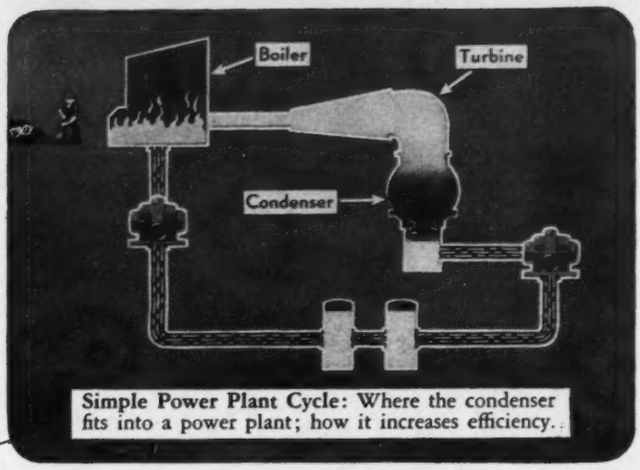
Laboratory Demonstration: Shows that a warm vapor plus a cool surface equals condensation.



Animation: Cutaway sketch of condenser chamber shows steam condensing on surface of tubes.



Construction: Actual production scenes tell story of assembling one of these important machines.



Simple Power Plant Cycle: Where the condenser fits into a power plant; how it increases efficiency.

NOW for the first time — you can study the interior of this important machine in Allis-Chalmers' new movie, "The Surface Condenser."

BECAUSE POWER PLANTS today lean heavily on Surface Condensers for new high efficiencies ... Because engineers, students, men in government, industry and the armed services can use more information about Surface Condenser operation and construction — Allis-Chalmers offers you a new sound motion picture, "The Surface Condenser."

Using animation and shop photography, this film demonstrates the "condensation" theory, shows how a condenser is built, how it operates in the power plant cycle.

Contains no advertising. 16 millimeter prints are available to all for free loan or purchase. Running time is 18 minutes, and the film can be used on sound projectors *only*. To obtain your print, just fill in and mail the coupon at right.

If you want to keep "The Surface Condenser" as a permanent addition to your film library, you can buy a print at cost for $24.

Note: This film when used in conjunction with Allis-Chalmers Steam Turbine movie, "The Magic of Steam", gives you a full 40-minute program on turbines and condensers. If you wish to show them together, ask for both films when filling out coupon at right. A 1697

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Milwaukee 1, Wisconsin

FREE!

Gentlemen:

☐ I would like to borrow one 16 mm. print of your new sound movie, "The Surface Condenser" for showing before

.....

.....on.....1944

☐ Lend me also a print of your Steam Turbine Movie, "The Magic of Steam".

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Because of its high conductivity and consequent low current losses, copper has always been the most widely used material for bus conductors.

To these advantages may be added such further qualifications as high thermal conductivity, high strength, high resistance to corrosion and ready availability of accessory equipment. Wherever modern electrical engineering practice dictates bus construction embodying structural strength, low ohmic and reactance losses or effective heat dissipation, the wide range of *copper bus shapes made by The American Brass Company will meet every requirement.*

In addition to a complete line of copper bus bars of rectangular shapes, this Company makes high conductivity pipe and tube, stranded cables and many special shapes.

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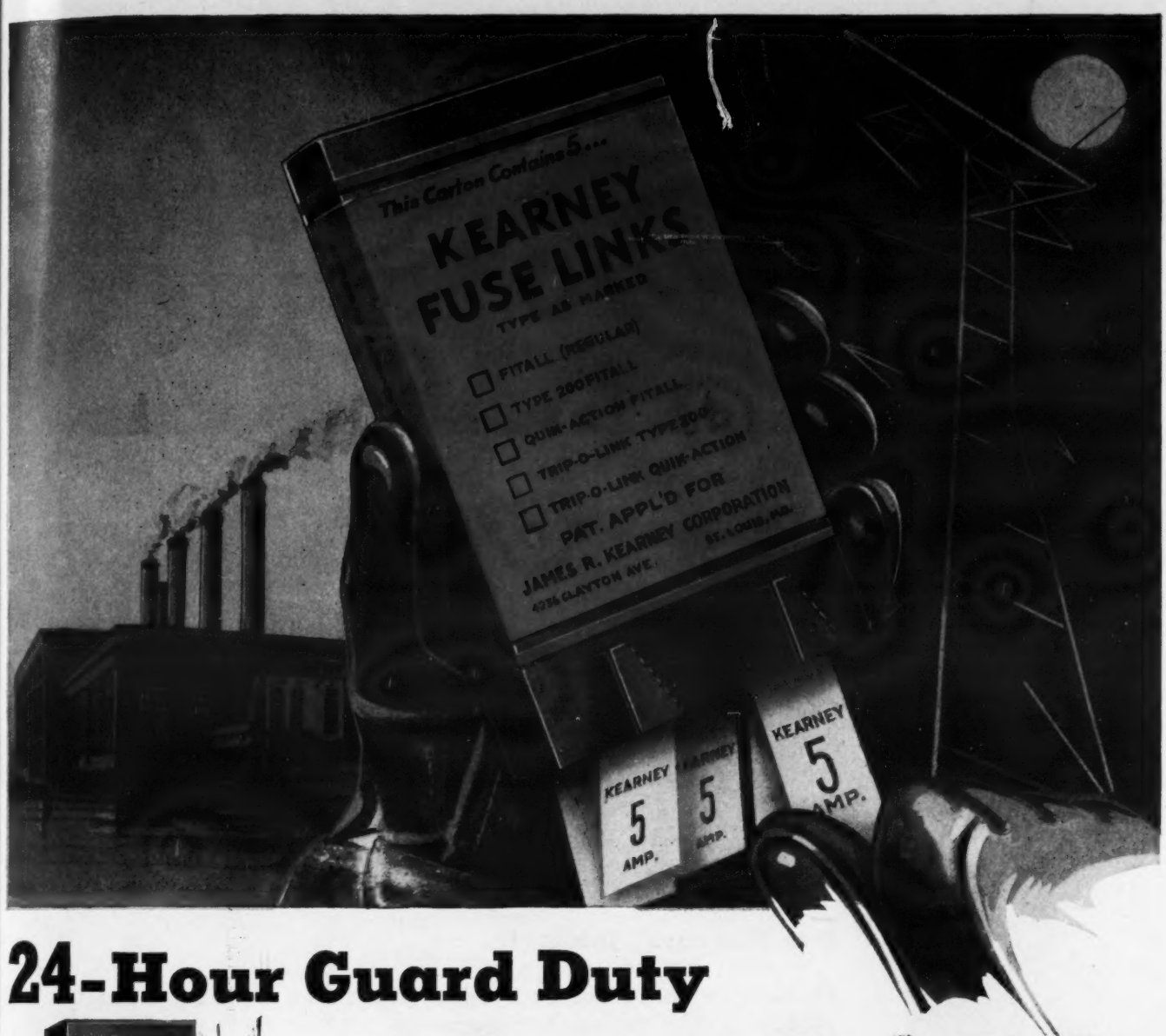

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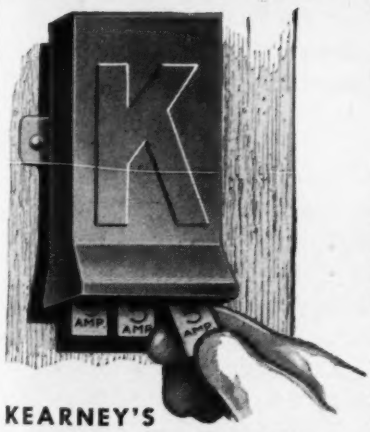

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at the RIGHT TIME

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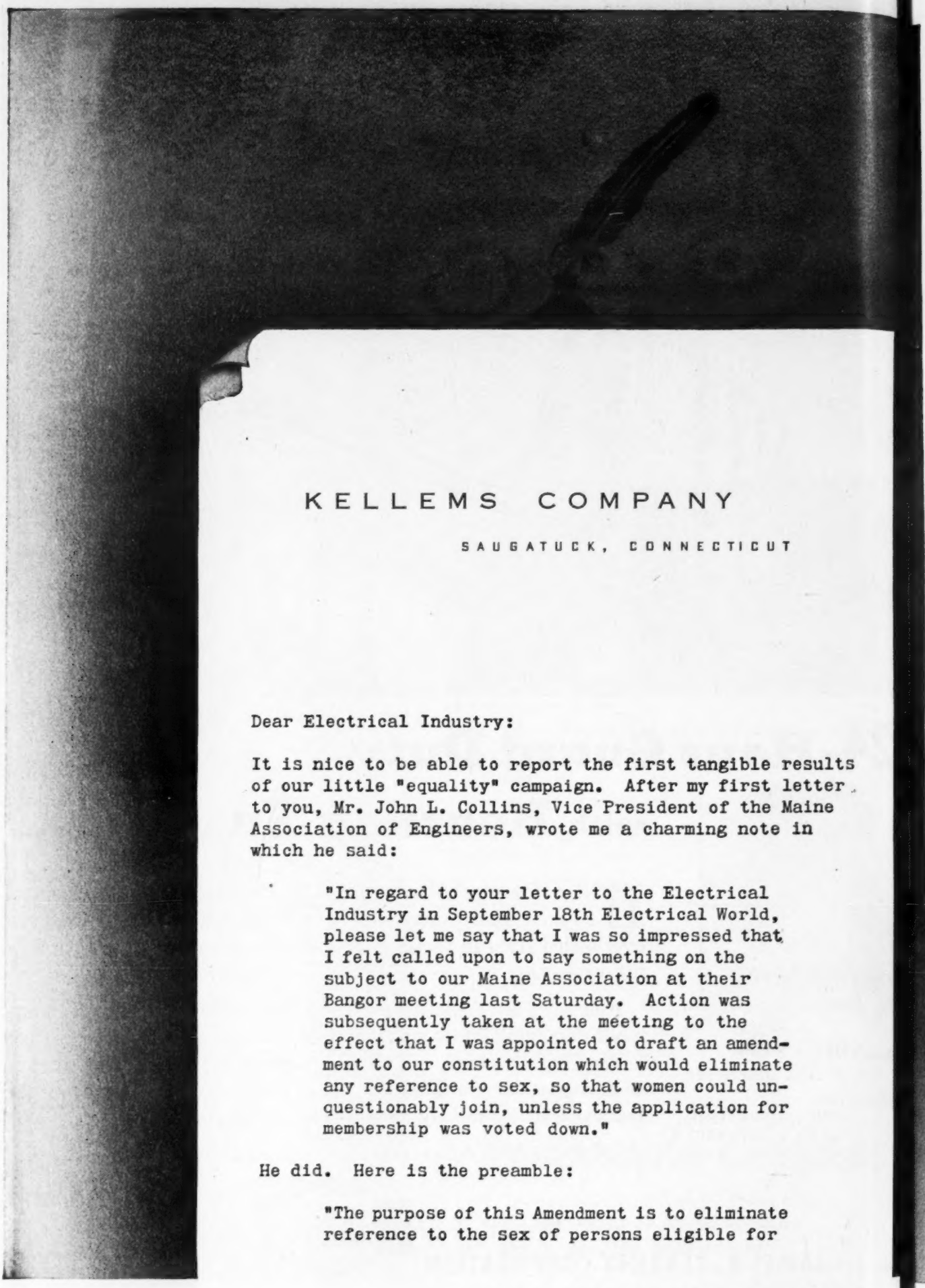
4224-42 CLAYTON AVE.
SAINT LOUIS, MISSOURI



KELLEMS COMPANY

SAUGATUCK, CONNECTICUT

Dear Electrical Industry:

It is nice to be able to report the first tangible results of our little "equality" campaign. After my first letter to you, Mr. John L. Collins, Vice President of the Maine Association of Engineers, wrote me a charming note in which he said:

> "In regard to your letter to the Electrical Industry in September 18th Electrical World, please let me say that I was so impressed that I felt called upon to say something on the subject to our Maine Association at their Bangor meeting last Saturday. Action was subsequently taken at the meeting to the effect that I was appointed to draft an amendment to our constitution which would eliminate any reference to sex, so that women could unquestionably join, unless the application for membership was voted down."

He did. Here is the preamble:

> "The purpose of this Amendment is to eliminate reference to the sex of persons eligible for

membership, so that no constitutional hindrance will exist to prevent the election of women to membership in, or as officers of, this Association."

On February 12th it was my pleasure to speak for the annual banquet of the Maine Association of Engineers and to hear the announcement that the resolution had been passed that afternoon.

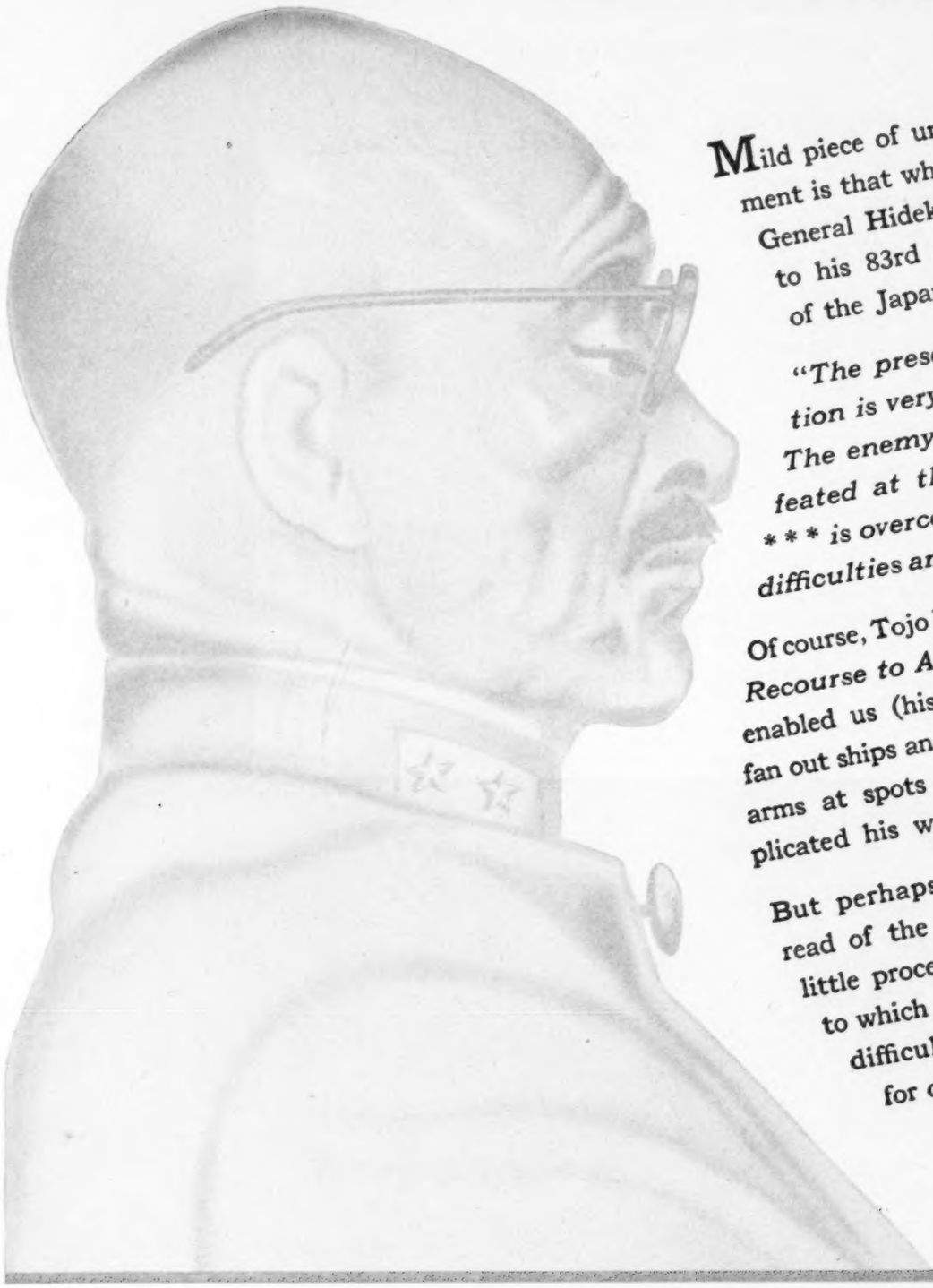
Congratulations, Maine Association of Engineers! May your numbers increase!

Sincerely yours,

Vivien Kellems

Then he said to himself

"VERY COMPLICATED, PLEASE"



Mild piece of understatement is that which Premier General Hideki Tojo made to his 83rd special session of the Japanese Diet:

*"The present war situation is very complicated. The enemy who was defeated at the beginning * * * is overcoming many difficulties and dangers."*

Of course, Tojo has read how *Recourse to Arc Welding* enabled us (his enemy) to fan out ships and planes and arms at spots which complicated his war situation.

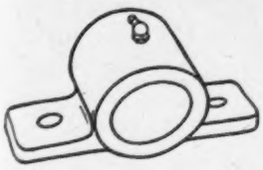
But perhaps he has not read of the mountains of little procedures, recourse to which overcame many difficulties and dangers for our production men.

"OVERCOMING DIFFICULTIES AND DANGERS"—he says

Look, Tojo: How having *Recourse to Arc Welding*, the production of war tools became *very simplified* for us . . . while their effect really made your position "VERY COMPLICATED."

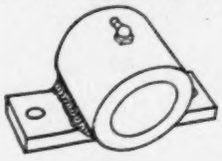
And think how in postwar they will make competition "Very Complicated" for a great many standpatters in production techniques.

VERY COMPLICATED, PLEASE



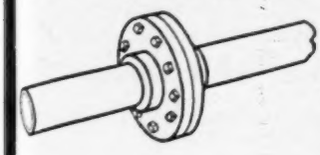
Drum shaft bearing . . .
Make pattern . . .
Mould . . .
Sand-blast . . .
(Cost in rough, $1.05)
Bore . . . Machine . . .
Drill holes.

VERY SIMPLIFIED, THANKS



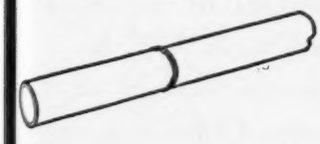
Cut strap and drill holes . .
Saw piece of tubing . . .
Arc weld into unit. . . .
Total cost $0.50.

VERY COMPLICATED, PLEASE



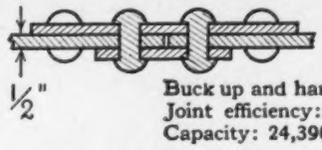
Connection in 10" steam pipe line . . .
Cut and thread ends of pipe . . .
Assemble with 2 flanges, gasket and set of bolts.
Joint requires maintenance.

VERY SIMPLIFIED, THANKS



Arc weld bevelled-end pipe . . .
A permanent, leak-proof joint.

VERY COMPLICATED, PLEASE



Structural joint requiring ½" plates . . .
Layout plates and straps accurately . . .
Drill holes accurately . . .
Put red-hot rivet in each hole . . .
Buck up and hammer down rivet heads . . .
Joint efficiency: 81.3%
Capacity: 24,390 lbs. per inch.

VERY SIMPLIFIED, THANKS

Only 7/16" plates required . . .
Bevel edge of plates . . .
Arc weld plates . . .
Joint efficiency: 100%
Capacity: 26,250 lbs. per inch.

VERY COMPLICATED, PLEASE

Axle for hay rake . . .
Make dies . . .
Forge parts . . .
Machine to fit . . .
Thread truss rod . . .
Assemble by bolting . . .
100% cost for loose-working assembly.

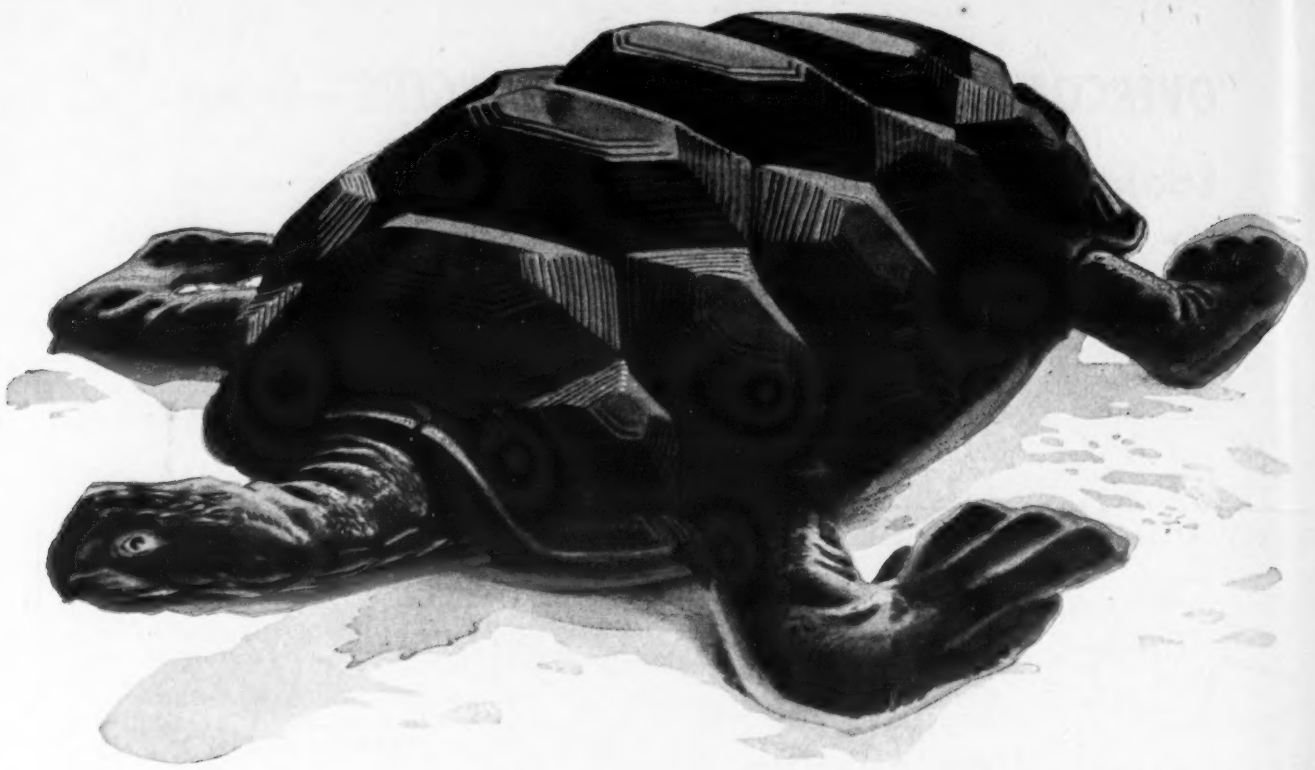
VERY SIMPLIFIED, THANKS

Cut angle, strap, bar and plate . . .
Arc weld into one unit . . .
70% cost for permanent assembly.

THE LINCOLN ELECTRIC COMPANY • CLEVELAND 1, OHIO

America's greatest natural **recourse**

ARC WELDING



Let's Talk About Plastic Housings

When housing problems arise, take a tip from the turtle. His plastic casing is a model of good design. Light in weight, it has toughness and strength in proportion to the protection it must give—and, large or small, the housing of the turtle always fits its tenant and his operations.

Burgess Vibro-tool with LUMARITH housing . . . shock-proof—comfortable to handle—50% lighter than metal.

For mechanical and electrical housings, such as control boxes, hand tools, shavers, radios, telephones, etc., it is logical to turn to plastics. Lumarith, in both cellulose-acetate and ethyl-cellulose formulae, brackets the full range of thermoplastic advantages. There is a Lumarith formula for every housing job. High impact strength, dielectric strength, moldability, toughness, dimensional stability at all temperatures, transparency, color and surface permanence can be obtained by specification. All Lumarith plastics are distinguished by their lack of brittleness.

It is likely that Lumarith is being used for housings of the type in which you are interested. You are cordially invited to call on our technical staff for factual assistance. Celanese Celluloid Corporation, *The First Name in Plastics*, a division of Celanese Corporation of America, 180 Madison Avenue, New York City 16.

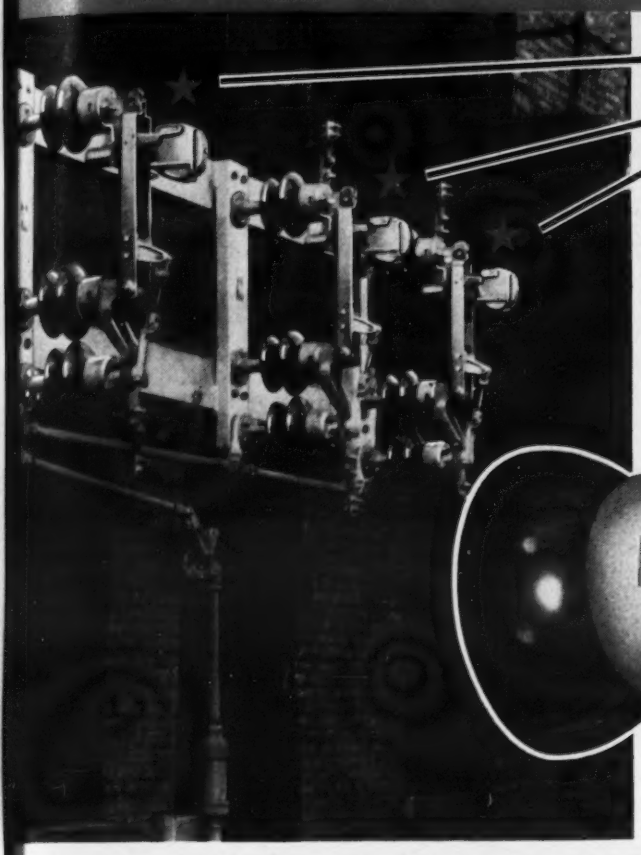
Lumarith*
A CELANESE* PLASTIC
for Housings

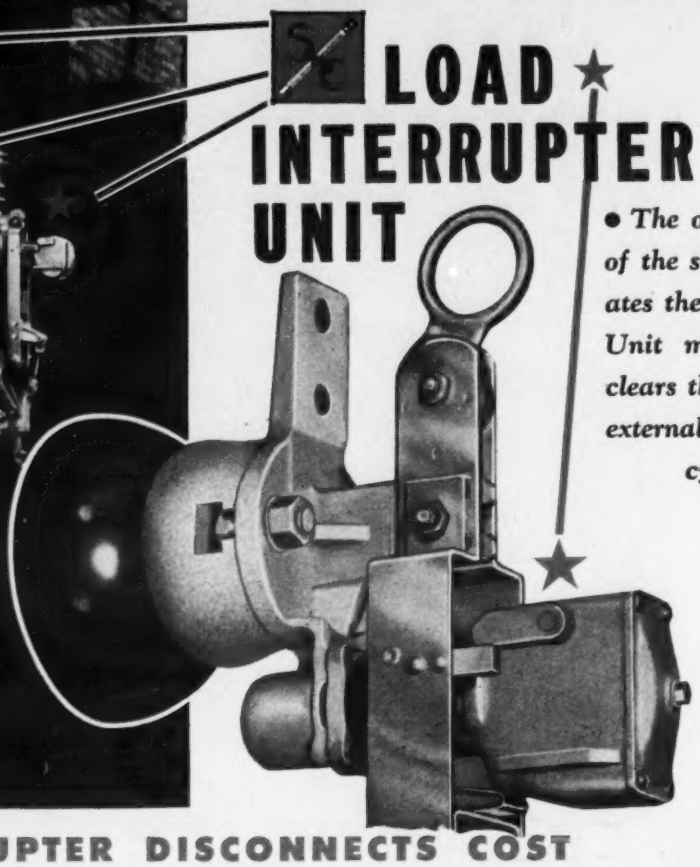
*Reg. U. S. Pat. Off.

TUNE IN
The Celanese* Hour — "*Great Moments in Music*"*
Columbia Network, Wednesdays, 10 P. M., E. W. T.

WIDELY INCREASED USAGE

. . . THE RESULT OF S & C FIELD PERFORMANCE





LOAD INTERRUPTER UNIT

● *The opening movement of the switch blade actuates the Load Interrupter Unit mechanism, which clears the circuit without external arcing . . . in a cycle or less.*

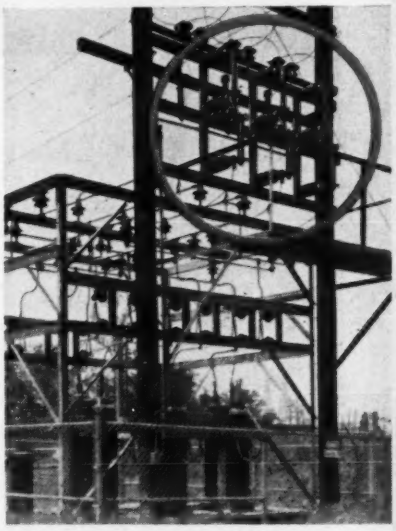
S&C LOAD INTERRUPTER DISCONNECTS COST BUT LITTLE MORE THAN CONVENTIONAL DISCONNECTS

Widely installed over a period of several years, performance records have been established which fully justify the continued increase in the installation of S & C Load Interrupter Disconnects.

Load currents up to 400 amperes at 15,000 volts can be interrupted safely—and without arcing at the main switch contacts. And these load-breaking Switches cost but little more than conventional disconnects.

They meet many load switching requirements at substantial initial and maintenance savings over larger circuit breaking equipment.

Further—in combination with S & C Fuses, as in the substation installation shown at right—both load switching and short circuit protection are provided. No Horn Gap Switches needed here. You have one piece of apparatus to install in place of two, saving space and weight, and reducing installation time.



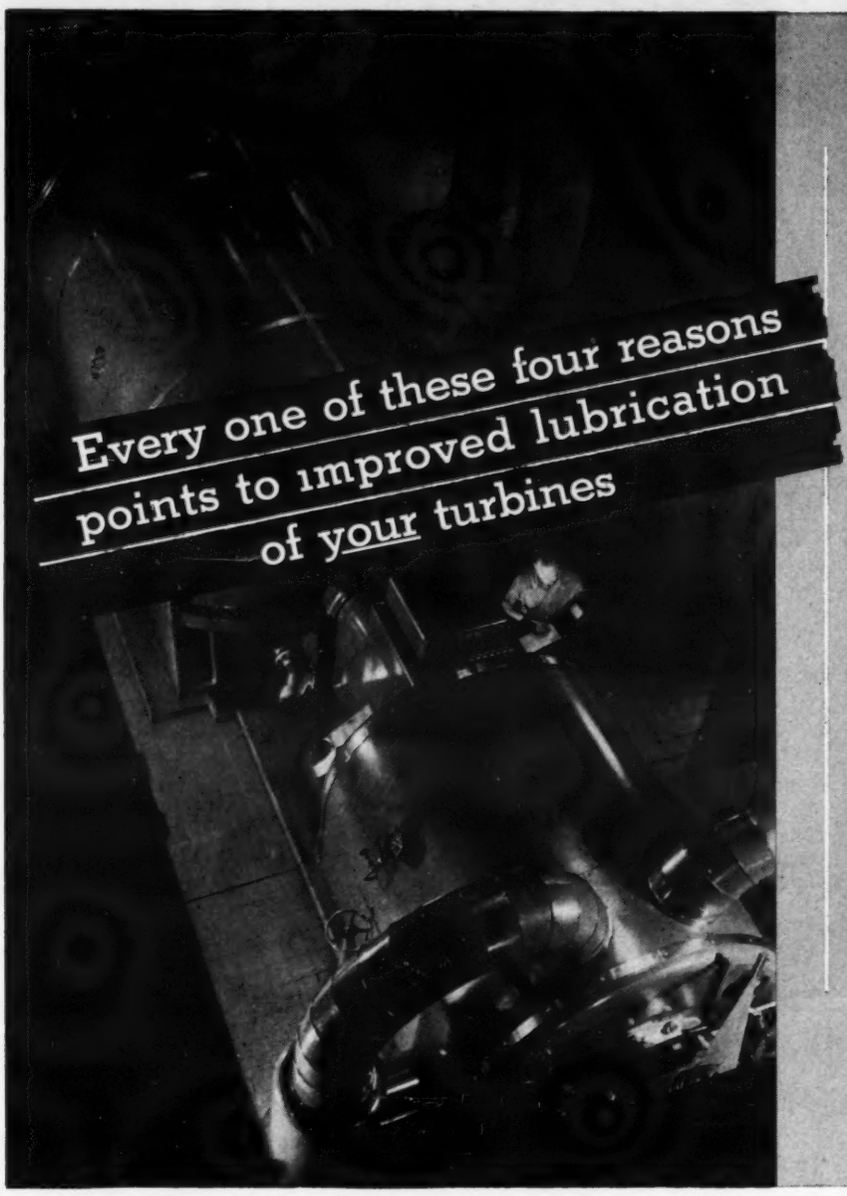
S & C Load Interrupter Disconnect and Fuse Combination on primary of transformer substation. The Heavy Duty Fuses have short-circuit interrupting ratings of:—20,000 r.m.s. amperes at 13,200 volts; 25,000 r.m.s. amperes at 6600 volts; 30,000 r.m.s. amperes at 2300/4000 volts.

MADE IN *BOTH* OUTDOOR AND INDOOR TYPES

SCHWEITZER & CONRAD, Inc.

4435 Ravenswood Avenue **Chicago 40, Illinois**

Supplied in Canada through Powerlite Devices, Ltd., Toronto, Ontario



4 reasons why Gulfcrest Oil LEADS THE FIELD

1 **REFINED BY THE ALCHLOR PROCESS.** The most thorough and effective method for removing chemically active or unstable hydrocarbons as well as other impurities present in all crudes.

2 **HIGHEST RESISTANCE TO OXIDATION.** Because this famous ALCHLOR Process synthesizes and rearranges the molecular structure of certain hydrocarbons more susceptible to chemical change in service, the finished oil has greater stability. GULFCREST OIL stands alone in its high resistance to oxidation.

3 **HIGHEST RESISTANCE TO THE FORMATION OF ORGANIC ACIDS AND SLUDGE.** Because of the elimination or rearrangement of the less stable hydrocarbons, the unparalleled refining power of Alchlor Process provides oils that form less gum and deposits, less sludge, and a higher resistance to emulsification when mixed with water, insuring years of uninterrupted service.

4 **MAXIMUM K.W. OUTPUT PER UNIT OF CONSUMPTION.** Because the Alchlor Process not only makes possible an oil more highly refined and homogeneous but with a greater resistance to oxidation and deterioration, longer life is insured and less make-up oil is required.

Gulfcrest Oil has the two important assets you want in a turbine lubricant: *superior lubricating value, longer life!*

These assets are the result of more thorough and more complete refining. For Gulfcrest Oil is not only refined by conventional methods, but is super-refined by the Gulf Alchlor Process, the most effective method for producing a turbine oil with maximum resistance to oxidation and sludge. Gulfcrest Oil is the world's finest turbine lubricant!

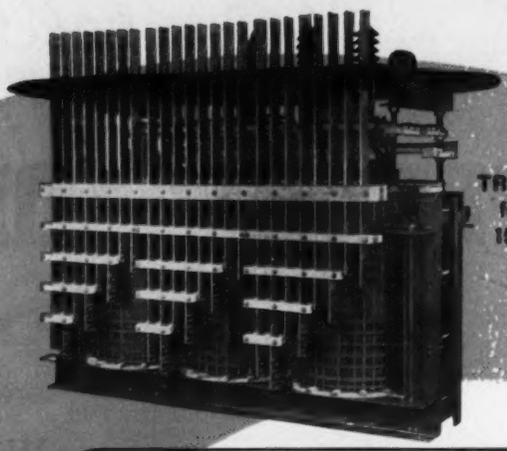
Call in a Gulf Lubrication Service Engineer and ask him to show you how Gulfcrest Oil can help you get improved lubrication and higher operating efficiency. Write, wire, or phone your nearest Gulf office today.

GULF INDUSTRIAL LUBRICATION

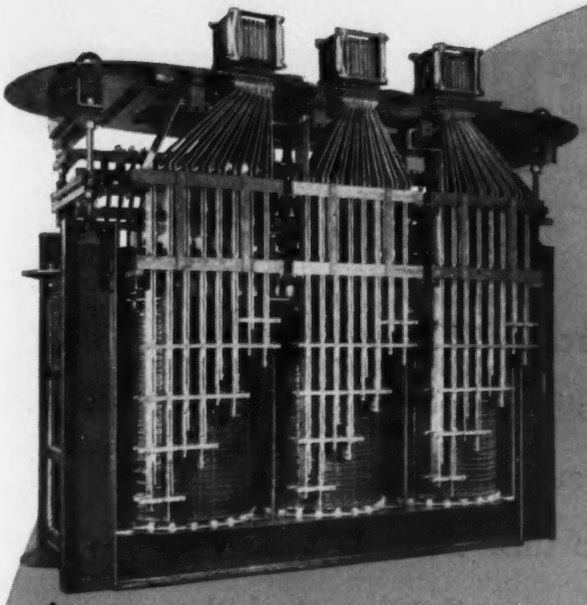
Gulf Oil Corporation · Gulf Refining Company
Gulf Building, Pittsburgh 30, Pa.

BACK THE ATTACK . . . BUY MORE WAR BONDS

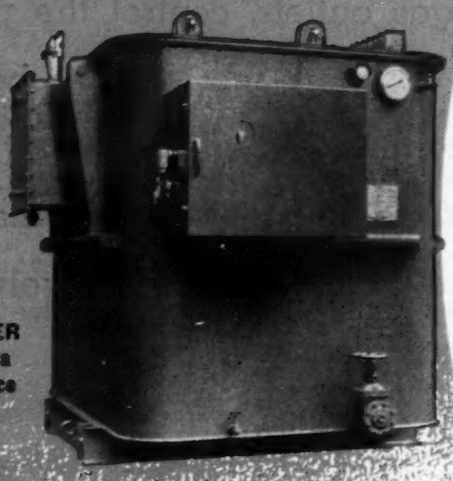
¾ MILLION KVA of Pennsylvania Furnace Transformers *now in Service!*



5000 KVA TRANSFORMER for operating a 15-Ton Furnace



15000 KVA TRANSFORMER for operating a 75-Ton Furnace



7500 KVA TRANSFORMER for operating a 30-Ton Furnace

YES, Pennsylvania Furnace Transformers, totaling ¾ Million KVA, are supplying power to hundreds of electric furnaces. The successful operation of these transformers has given Pennsylvania Transformer Company a noted reputation in the Furnace Transformer field. For over 30 years, Pennsylvania Engineers have closely followed the development of Electric Furnaces. They fully understand the problems of Electric Furnaces and their relation to Furnace Transformers.

SOME PROBLEMS OF DESIGN AND HOW THEY ARE MET

1. *Overloads.*

Electric Furnace operation inherently subjects Furnace Transformers to heavy overloads. To carry these overloads safely, a low temperature gradient must be maintained between copper and oil. Pennsylvania coils are designed so that a large surface of each wire in the high voltage and low voltage windings is directly exposed to the cooling oil. Large vertical ducts distribute the oil through the coils. Ducts are clear and unobstructed; hot spots cannot develop in the windings.

2. *Balancing of Stresses.*

Pennsylvania coils are balanced to reduce the radial and axial short circuit stresses to a minimum. 1. The circular shape protects the coils against deformation due to radial short circuit forces. 2. The total axial short circuit force is calculated for each design and the coils are subjected to an equivalent pressure in a three hundred ton hydraulic press. The ability of the coils to maintain their shape, under the prescribed pressure, guarantees that the transformer will safely withstand short circuits.

3. *Distribution of Currents.*

Due to heavy secondary currents, the windings must be subdivided into numerous parallel sections. A skillful arrangement of the windings insures that each section carries an equal share of the current. Careful transposition of the individual conductors of each section in the windings reduces the copper eddy losses to a minimum. This results in improved efficiency, more uniform copper temperature and prevention of hot spots.

Pennsylvania TRANSFORMER COMPANY

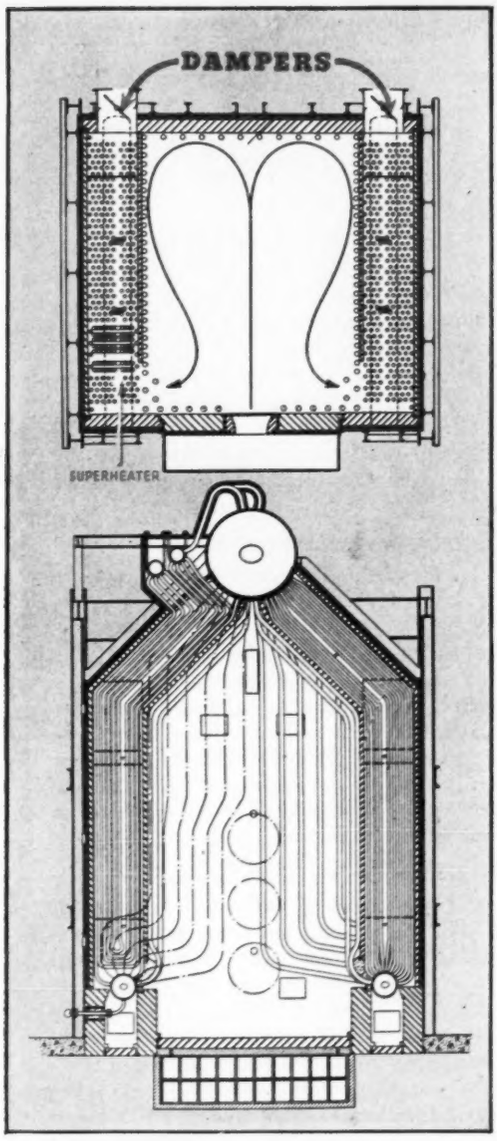
Pennsylvania TRANSFORMERS

Furnace Transformer Experts

PITTSBURGH, PENNSYLVANIA

Blazing THE

SUPERHEAT CONTROL
in "S-A" Boilers



• Wide range superheat control in "S-A" type boilers is accomplished by placing all superheating surface in one of the twin tube banks. Dampers, placed in the gas outlets, control the proportion of gas flow through this bank to give constant superheat under varying load conditions. Note that the dampers are placed in a relatively cool temperature zone.

Foster Wheeler is a Three-Star winner under the U. S. Navy Board of Awards for production.

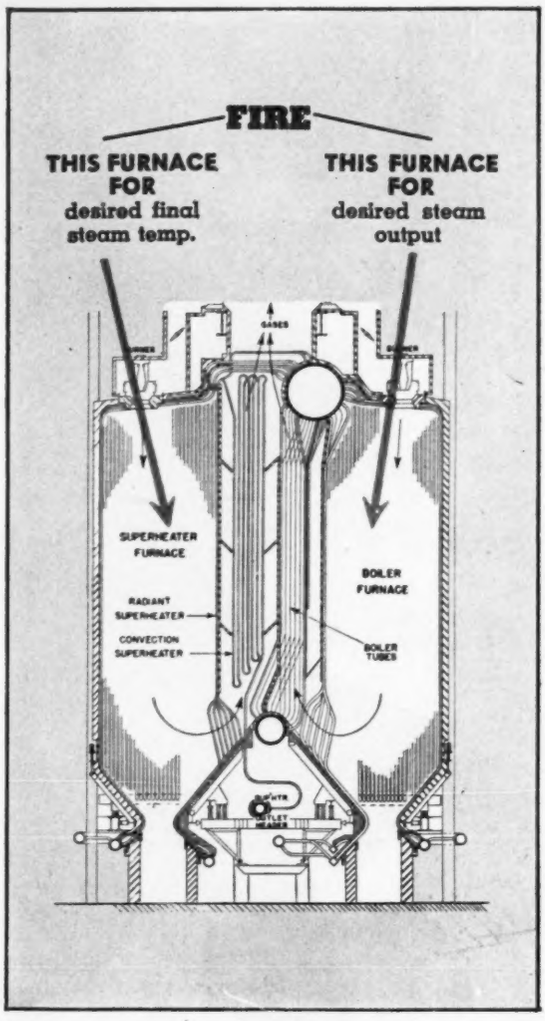
FW FOSTER

ENGINEERING TRAIL

SUPERHEAT CONTROL
in Twin Furnaces

• Final steam temperature is determined by rate at which superheater furnace is fired and, therefore, steam temperature can be kept constant or varied at will independent of the quantity of steam produced, rapidity and width of load swings, changes in feedwater temperature or influence of other factors.

The use of the combination radiant and convection superheater gives an additional temperature control which simplifies operation, i.e., with increasing load the superheat increases on convection section and decreases on radiant section. By proper proportioning of the radiant and convection sections, superheat can be held virtually constant from 40% to 100% normal load. Below 40% of load, superheat can still be kept constant by firing superheater furnace slightly harder than boiler furnace.



FOSTER WHEELER CORPORATION
165 BROADWAY, NEW YORK 6, N. Y.

WHEELER FW

ILLINOIS

High Tension Gooseneck Porcelains for Transformer Entrance Wires

• Accuracy in control of production of ILLINOIS Porcelain assures exact dimensions plus high mechanical and high dielectric strength for perfectly balanced insulators. All sizes and shapes are available for high tension transformers of every type—ease of installation assured because of uniformity —right fit means dependable service.

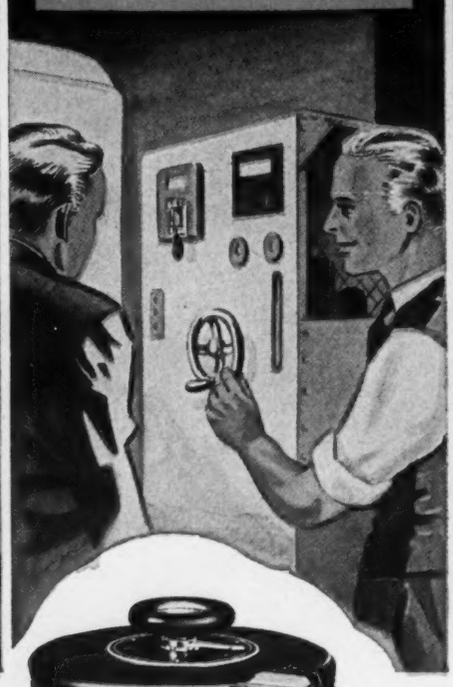
ILLINOIS ELECTRIC PORCELAIN CO., *Macomb, Illinois*

FOR YOUR PLANT

Transtats maintain required temperatures of heating elements or r.p.m. of voltage-sensitive variable speed motors and compensate for line fluctuations.

FOR YOUR PRODUCT

Transtats are neat, compact, and have no projections. They may be specified for rear-of-panel mounting with full assurance of dimensional conformance.



FOR YOUR LABORATORY

Close control plus stability under load changes make Transtats ideal for laboratory work.

PRECISE A.C. VOLTAGE CONTROL

WITH LOW CURRENT CONSUMPTION

For a continuously adjustable voltage or a constant voltage from a fluctuating source, specify Transtat A.C. Voltage Regulators. Their velvety smooth, practically stepless control is unmarred by current interruptions, arcing or line surges. They operate with high electrical efficiency and cannot reduce power factor or distort wave form. With a range from 0 to 100% rating, they may also be connected to provide higher than line voltages. Yet Transtats are no more expensive than many other voltage regulating devices. Write today for complete information covering manual, motorized and fully automatic Transtats. Ask for bulletin 51-2U.

• Cutaway view of a typical TH Transtat showing both outside case and arrangement of parts inside case.

★

AMERICAN TRANSFORMER COMPANY

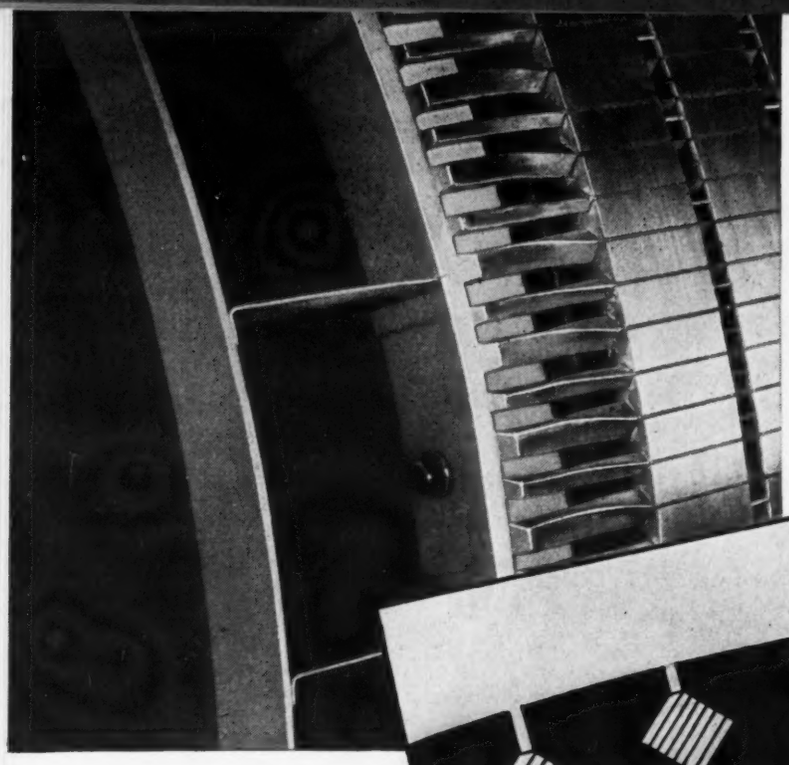
178 Emmet Street, Newark 5, New Jersey

AMER TRAN

Pioneer Manufacturers of Transformers, Reactors and Rectifiers for Electronics and Power Transmission

AMERTRAN

MANUFACTURING SINCE 1901 AT NEWARK N. J.



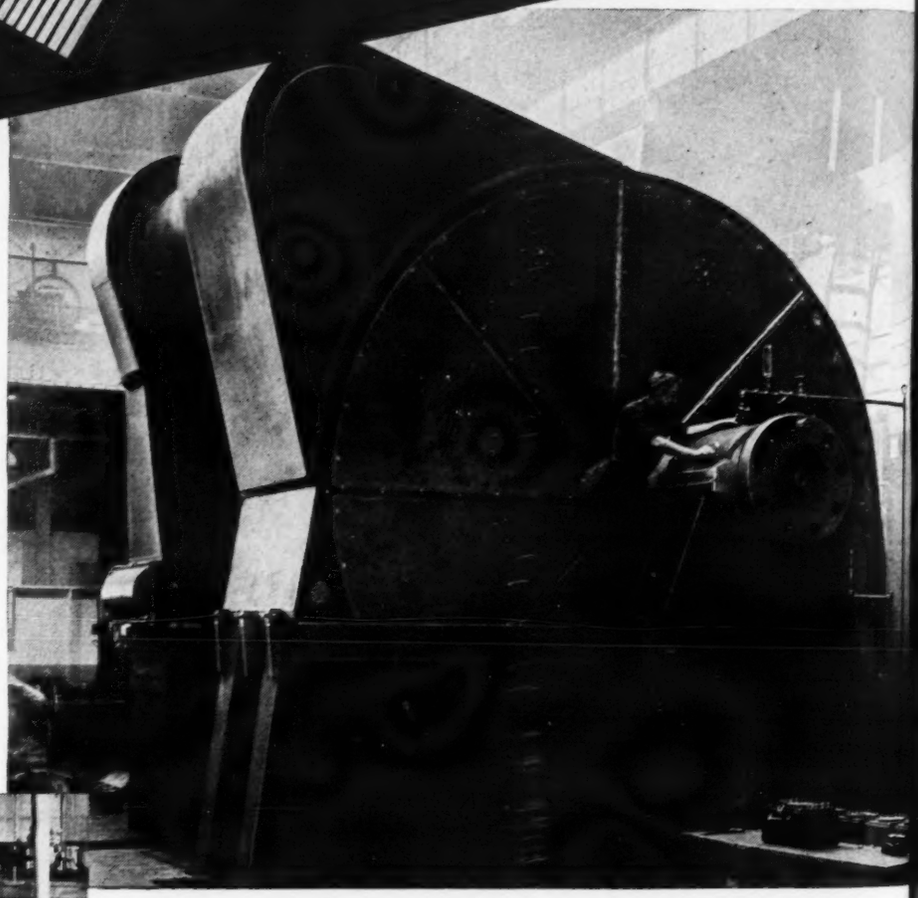
Elliott

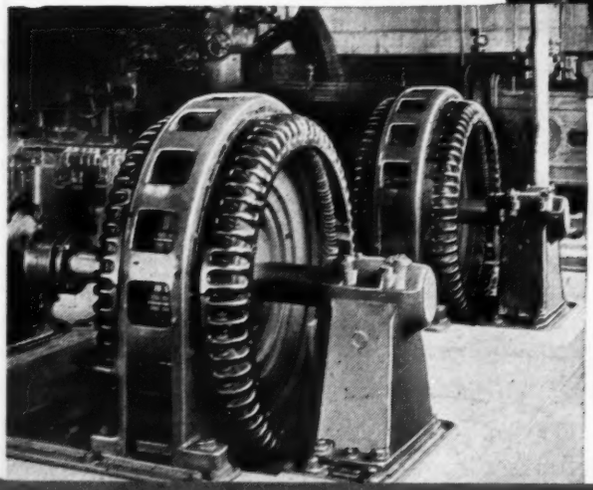
Detail of diamond cage arrangement, showing comparatively broad area, and consequent strength, of laminations.

At top: Close up of diamond cage construction as developed for Elliott squirrel-cage motors. The skewed formation of the bars assists mechanical stiffness.

At right: One of a large number of Elliott 6600-hp. synchronous motors for tanker propulsion. These motors have Elliott diamond cage winding. Photo shows motor completely covered, with its ventilating system. (In these vessels, Elliott furnishes also the main and auxiliary turbine-generators, desuperheaters, mechanical drive turbines.)

Below: Two Elliott engine-type synchronous motors driving compressors. Superintendent in this plant says these are the quietest motors he has ever seen.





ELLIOTT

engineering advances motor design

ELLIOTT DIAMOND CAGE CONSTRUCTION

- Achieves high starting torque, low starting current in A. C. motors—
- Small pole horns required reduce leakage flux in synchronous motors—
- Combines the most desirable ratio of cage resistances with the most favorable relation of cage reactances—
- Allows close nesting of bars with smallest sacrifice of strength of the iron section between bars—
- Affords means of eliminating all looseness between rotor stack and bars—
- Gives exceptional strength, and stiffness of the tip of stack—
- Combined with other structural features assures unusually quiet operation.

Ingenious engineering is characteristically Elliott. Tough problems which must be solved in new ways, are an interesting challenge to Elliott engineers, who are constantly designing special equipment for the individual job. Through this activity Elliott engineers have amassed facts and data of immense value, and have gained the habit of original thought which is an essential of all pioneering in any phase of human endeavor.

A case in point is the development by Elliott engineers of "diamond-cage" construction in squirrel-cage motor design. On the sound basis of overall results and long-term performance, we believe this construction is superior among the many efforts of motor designers to meet the requirements in this problem.

Full details of this development, including graphs of comparative tests, and data on the motors of which it is a part, may be had at request.

ELLIOTT COMPANY

Electric Power Department, **RIDGWAY, PA.**

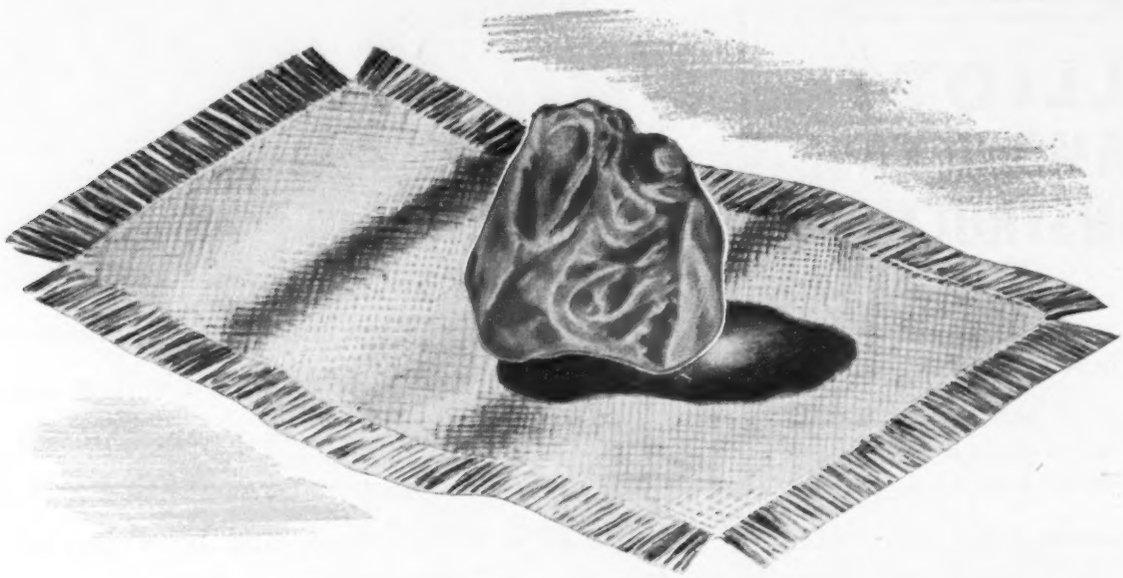
DISTRICT OFFICES IN PRINCIPAL CITIES

L-749

builds fine motors

BAKELITE

TRADE MARK



HERE'S YOUR "TRACKING" TEAM

Now—plastics research has combined Fiberglas fabric and BAKELITE Laminating Plastics to bring you a durable insulating material that is more resistant to surface tracking than any other laminated plastic yet developed. Although its arc resistance (A.S.T.M. D-495-41) is 185 seconds, it is extremely tough – having tensile strength and flexural strengths of 11,500 and 20,000 pounds per square inch respectively.

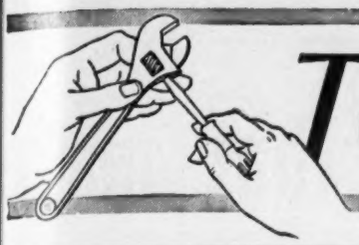
This special arc-resistant plastic is available in sheets, tubes, and rods of various dimensions. Where quantity justifies the cost, it also may be custom-molded into simple, three-dimensional shapes. In common with other types of high-pressure laminated plastics, it can be sheared, punched, and machined with metalworking tools.

Investigate the opportunities for improving both the mechanical and electrical characteristics of your equipment with laminated plastics by writing Department 47. Bakelite Corporation also will be glad to put you in touch with fabricators who can supply your immediate essential needs or advise you on specific applications.

BAKELITE CORPORATION, 30 E. 42 St., New York 17
Unit of Union Carbide and Carbon Corporation

UCC

Laminating Plastics

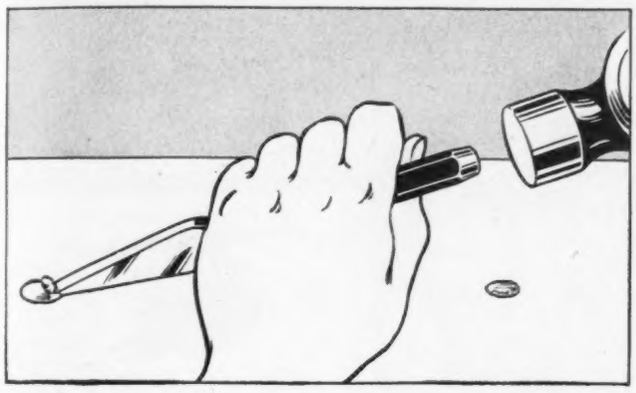


TOOL NOTES

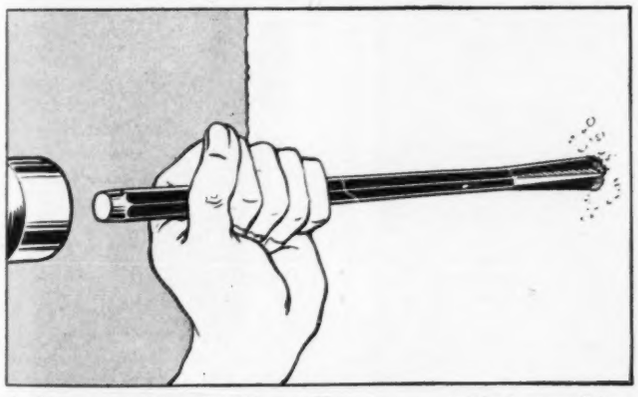
"How To Do It" Information For Crescent Tool Users

No. 19 . . . . PICKING THE PROPER TOOL FOR THE JOB

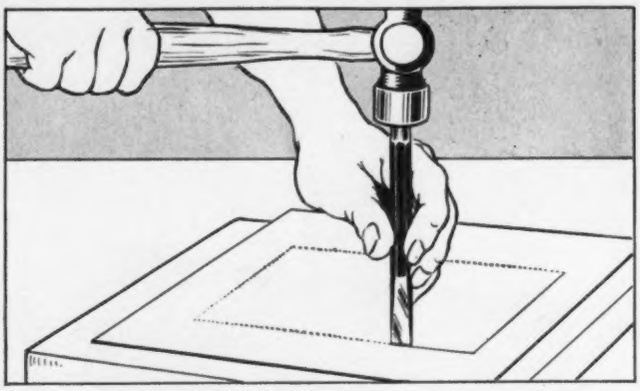
A few simple rules will help in selecting the proper cold chisel or punch. In making your selection, remember this basic rule: cold chisels are designed to cut only metals softer than the tool itself. Use a heavy hammer: a light hammer won't transmit the force of the blow to the cutting edge.



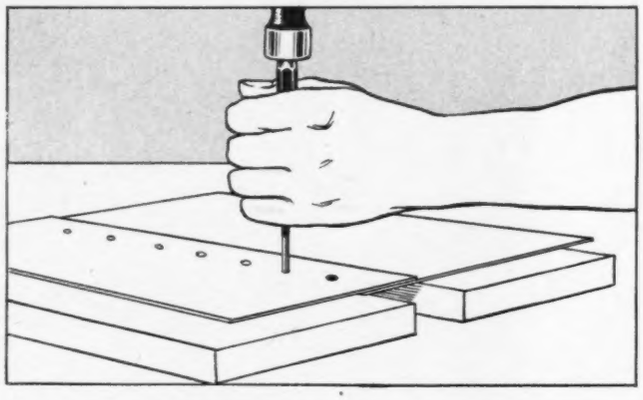
Probably the easiest way to remove a rivet head is to use a Crescent Cape Chisel, as illustrated. Cut through center section first, then knock off the two side wings.



A Crescent Star Drill is the proper tool for making holes in concrete or other masonry. Give the drill a quarter turn after each blow with a heavy hammer. In a pinch, a cold chisel will suffice but work is slower.



Use a Crescent Cold Chisel to cut sheet metal with a back plate. First scribe the line or design and with sheet laid on back plate, cut as illustrated. Finish edges with a file.



Use a Crescent Pin Punch to drive out a rivet or pin. Select a punch having a diameter slightly less than that of the rivet. A point too small may upset the end of a soft rivet and make it seize.

MAIL THE COUPON FOR FREE REPRINTS

This is No. 19 in Crescent's TOOL NOTES Series. These informative advertisements provide practical information for users of hand tools. Mail the coupon today!

CRESCENT TOOL COMPANY, JAMESTOWN, N. Y.

CRESCENT TOOLS
Give Wings to Work

Crescent Tool Co., Jamestown, N. Y. J-4

Please send your "TOOL NOTES" Series

☐ for Bulletins ☐ for 3-ring binder

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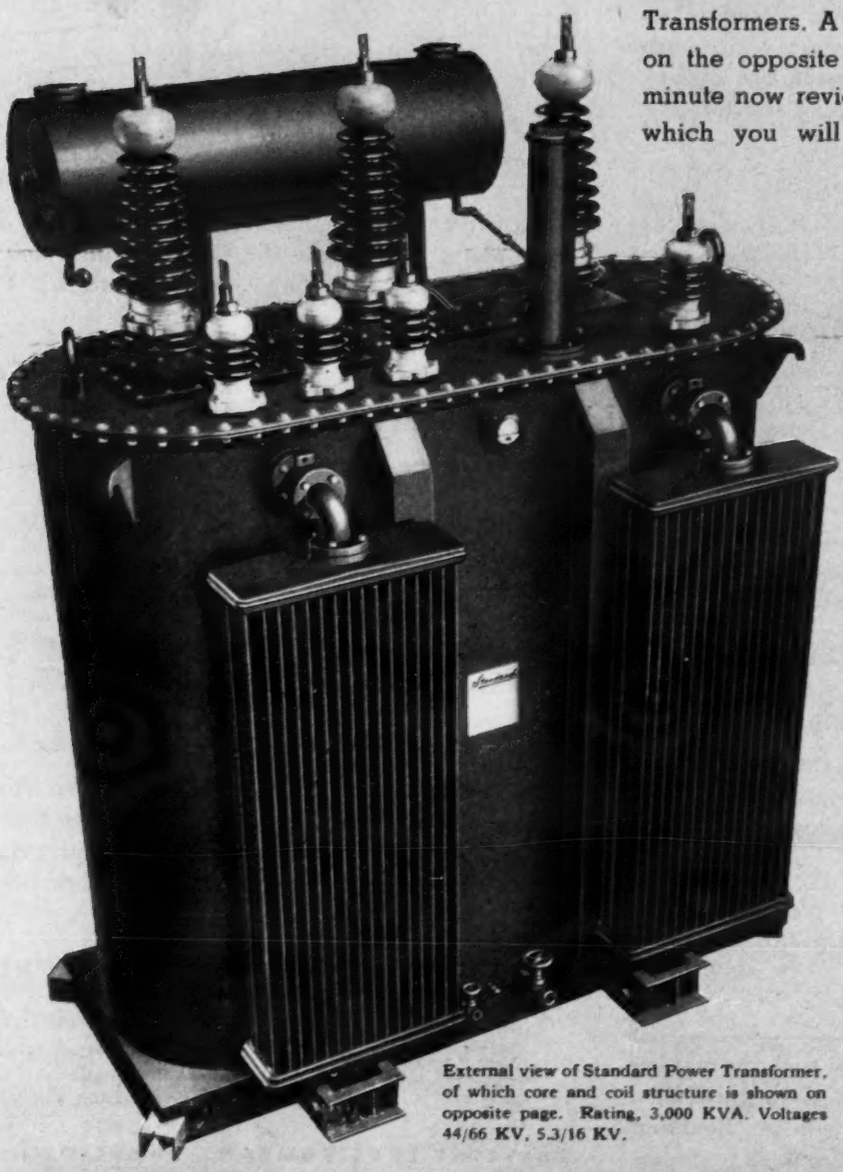
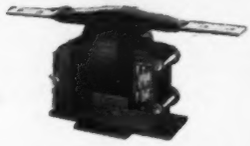
Examine the features that make

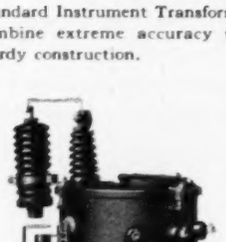
In addition to performance and rating figures, you certainly are interested in the engineering and structural details of as important a piece of equipment as a transformer. We take great pride in the features that are responsible for the good service records of Standard Transformers. A few of these details are highlighted on the opposite page. It will pay you to spend a minute now reviewing them, as they are points with which you will want to be thoroughly familiar.



External view of Standard Power Transformer, of which core and coil structure is shown on opposite page. Rating, 3,000 KVA. Voltages 44/66 KV, 5.3/16 KV.



Standard Instrument Transformers combine extreme accuracy with sturdy construction.



Standard makes a complete line of Distribution Transformers for Rural, Urban, Industrial and Building service.

THE STANDARD TRANSFORMER C

For every class of service: Distribution and Power · Current and Potential · Askarel Cooled · Rural

Standard Transformers

TRADE MARK

DEPENDABLE... ECONOMICAL

1 Bushings, properly sized and spaced, are oil filled, brown glaze, wet process porcelain with spade type terminals.

2 Core design provides double usual cooling area; is mechanically strong.

3 Rigid supporting structure assures long life and trouble-free operation.

4 Moisture completely removed from coils by preheating, vacuum impregnation with special varnish and baking.

5 Flashover protection provided by treated press board, varnished cambric, and insulating tubes.

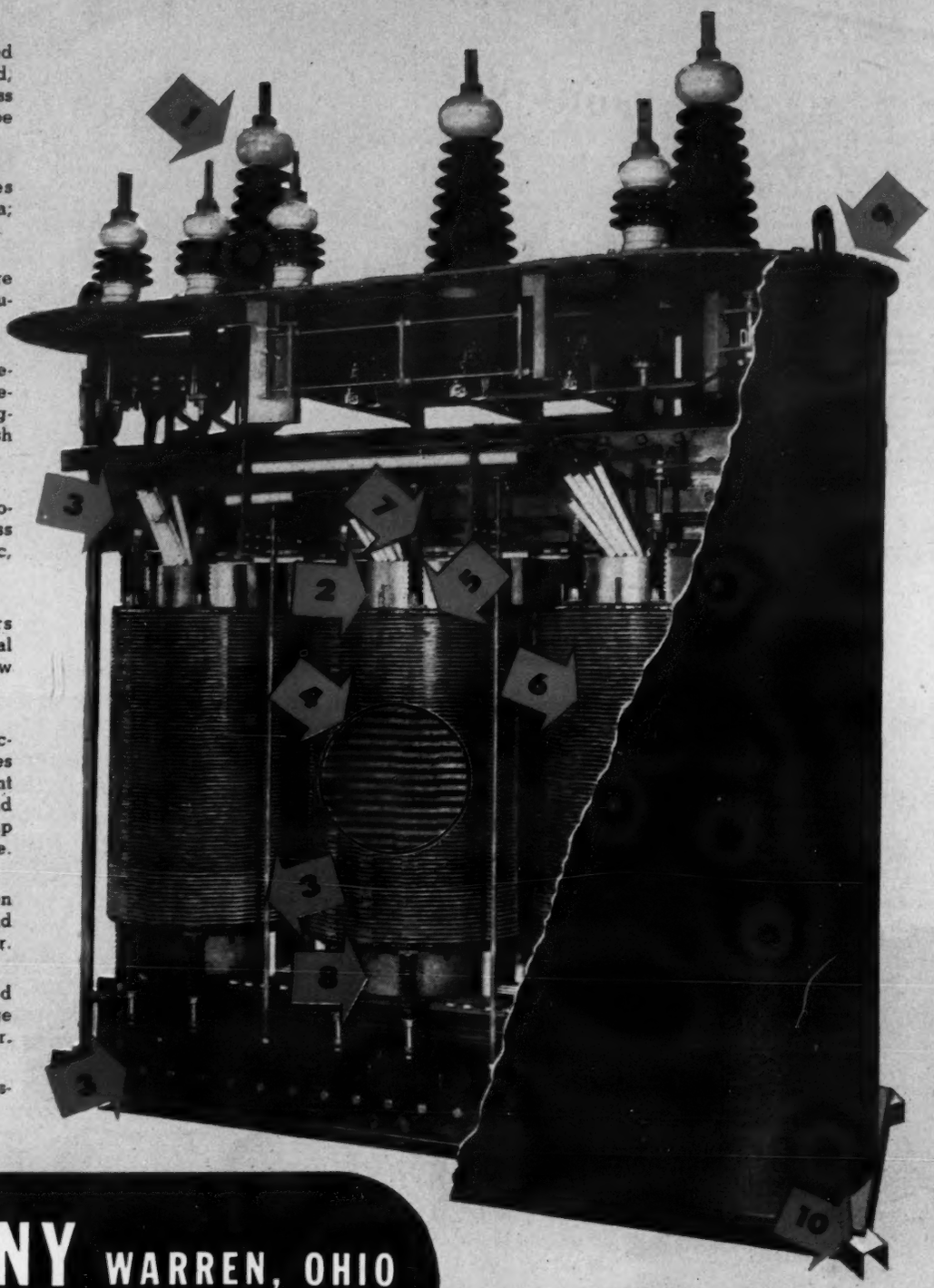
6 Treated fibre spacers placed radially in vertical columns permit free flow of oil to all parts of coils.

7 Unique spring construction on coil end braces permits slight movement of coils under abnormal load without damage and takes up any slack due to coil shrinkage.

8 Ample clearance between high voltage winding and core prevents flashover.

9 Specially developed gasket prevents leakage of oil or entrance of air.

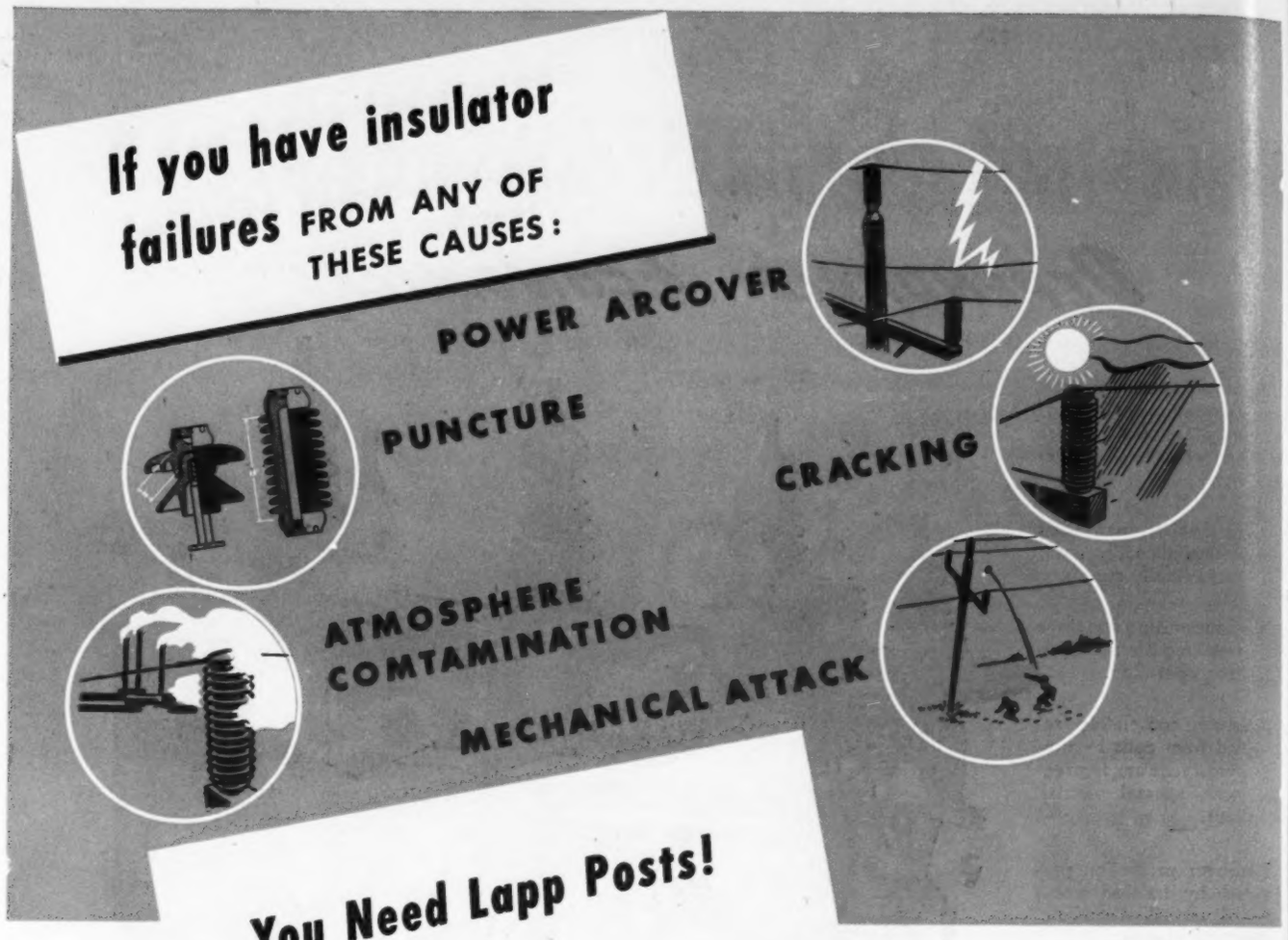
10 Welded jack bosses assist in handling.



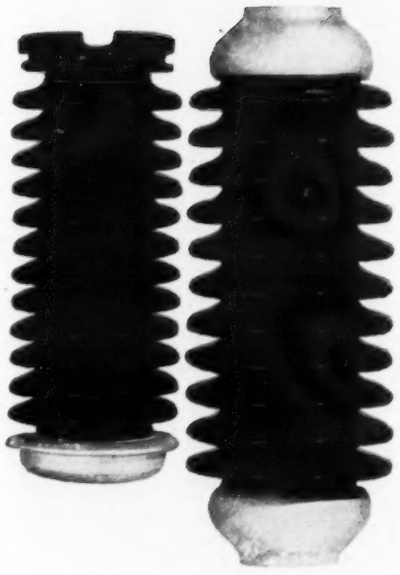
COMPANY WARREN, OHIO

General Purpose Dry Type · Auto Transformers · Street Lighting

REPRESENTATIVES IN PRINCIPAL CITIES



• Looked at from a dollars-and-cents viewpoint—or in terms of man-hours of under-staffed and over-worked patrol and maintenance crews—Lapp Line Posts and Station Posts are smart business. For the engineering achievement of these insulators—now proved by more than 12 years of service in the toughest areas—is that of eliminating at their source *all* the common causes of high-voltage insulator failure. A one-piece post body, with multiple short rugged petticoats, this Lapp design is proof against puncture and cracking, is capable of withstanding enormous shock from power arcover or mechanical attack, provides uniform leakage path for operation under dirt conditions. For replacement, new construction or line conversion, Lapp Posts on your transmission lines and substations will give better performance and less trouble.



Lapp

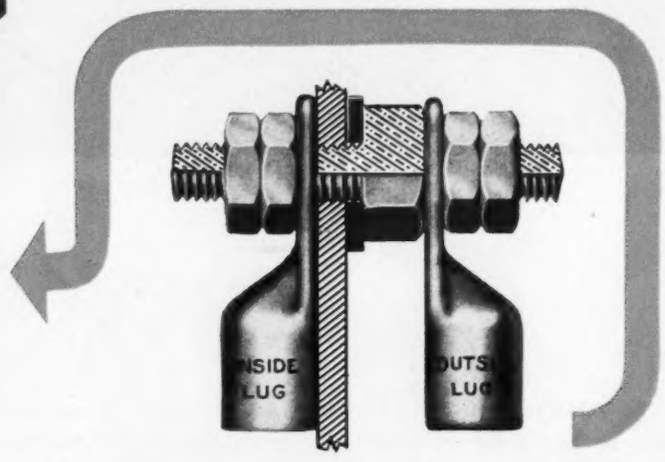
LAPP INSULATOR COMPANY, INC., LE ROY, N.Y.

Save material, Save space . . .

USE STANDARD 3 CONDUCTOR G&W POTHEADS

ON YOUR 4 CONDUCTOR GROUNDED NEUTRAL CABLES

It's simple as can be: if the fourth wire of your four-conductor cable is a grounded neutral, use a G & W three-conductor pothead with a neutral stud and lugs in the body —instead of a four conductor pothead. It serves perfectly, takes less space, saves appreciable material—and costs less. Entrance fittings for the base are readily available in standard interchangeable parts, for either four-conductor or four single-conductor cables.



This fact is important to remember: practically any G & W Pothead body can be fitted with a grounding stud, in front or at either side. The gasketed hex portion of the stud is an effective seal against moisture getting in, and compound or cable oil getting out. The extra cost is negligible.

Select the correct 3 conductor pothead in Bulletin 392. Add symbols "GL" to designate that pothead should be equipped with neutral ground stud and lugs. Specify conductor size. State preferred location of the stud in the body. If you haven't Bulletin 392, better write for a copy right away.

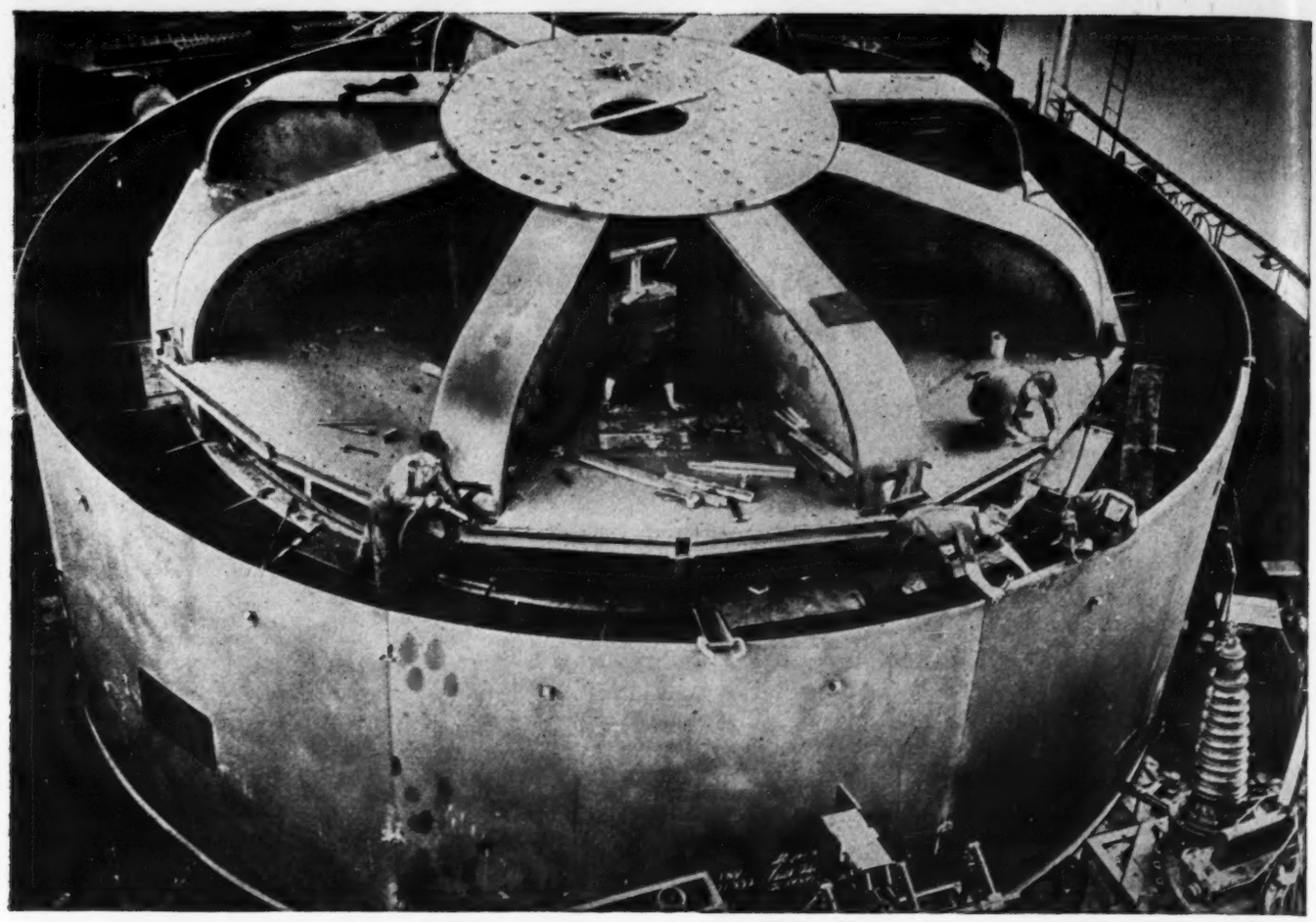
G&W ELECTRIC CABLE DEVICES

G & W ELECTRIC SPECIALTY CO.

7780 DANTE AVENUE • CHICAGO, ILLINOIS

In Canada—Powerlite Devices, Ltd., Toronto, Ont.

POTHEADS . . . BOXES . . . OIL FUSE CUTOUTS . . . OIL SWITCHES AND MULTIPLE CIRCUIT OIL DISCONNECTS



"Crowning" A STATOR

NO less than 12 of these giant 82,500-kw hydro-electric generators will soon be sending the mighty power of Boulder Dam throughout the Southwest.

Utilities are meeting an all-time high demand for power and are assured of peak performance by lubricating with Texaco.

Texaco Regal Oils (R & O), for example, keep steam turbine lubricating systems clean, bearing temperatures normal, governor action smooth and sensitive. They free themselves rapidly from air and water, and are highly resistant to gum formation and sludging. *They are rust and oxidation inhibited.*

So effective have Texaco Lubricants proved that they are definitely preferred in many fields, a few of which are listed at the right.

Texaco Lubrication Engineering Service is available to you through more than 2300 Texaco distributing points in the 48 States. The Texas Company, 135 East 42nd Street, New York 17, N. Y.

THEY PREFER TEXACO

★More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

★More locomotives and railroad cars in the U. S. are lubricated with Texaco than with any other brand.

★More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

★More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

★More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

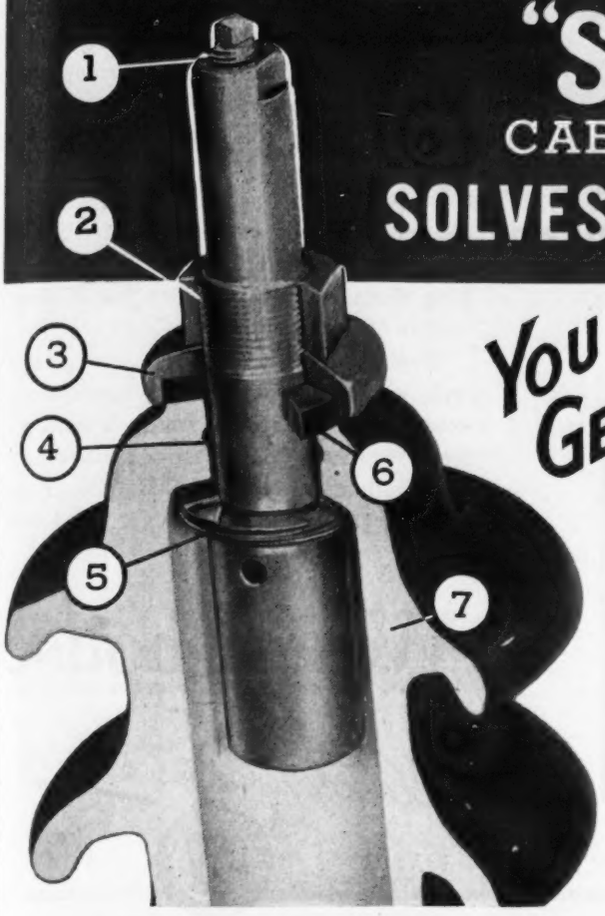
TEXACO

TEXACO Regal Oils

FOR ALL TURBINES

TUNE IN FRED ALLEN EVERY SUNDAY NIGHT—CBS ★ HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

"SEALKAP"
CABLE TERMINATOR
SOLVES SERVICE PROBLEMS



YOU GET MORE TROUBLE-FREE YEARS LESS RADIO INTERFERENCE with these DELTA-STAR FEATURES

1. Vented for Voidless Compounding
2. Drawnut Threads Carry No Current
3. Retainer Prevents Flowing of Gasket
4. Bushing Reduces Radio Interference
5. Compensation for Loss of Resilience
6. Oil-resistant Synthetic Rubber Gasket
7. Extra Heavy, Shock-resistant Porcelain

"SEALKAP" CONSTRUCTION PROMOTES LONG TROUBLE-FREE LIFE AND REDUCES RADIO INTERFERENCE

Thick oil-resistant synthetic rubber gasket (6) with practically no exposure to oil lengthens effective resilience and provides a radial seal on connector stud.

Gasket retainer (3) with close clearance to porcelain and metal bushing (4) with snug fit on connector stud reduce gasket flow to a minimum. Volume remains practically constant after drawnut is tightened. Metal bushing, being cast in porcelain and in contact with stud, reduces corona, resulting in less radio interference.

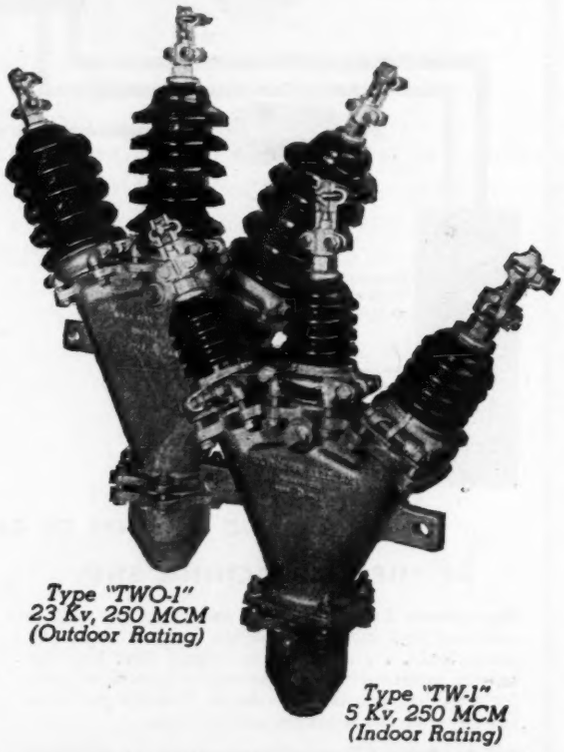
Spiral laminated spring washer (5) compensates for aging of gasket and consequent loss of resilience.

Vented studs permit air to escape freely when compound is poured—no voids.

Drawnut threads (2) carry no current—permits application of moisture repellent compounds.

Extra heavy porcelain bushing (7) minimizes breakage by missiles and strains.

Oil, vacuum, and water-tight seal is provided. Effective resilience of gasket is maintained and seal will not deteriorate throughout ordinary life of terminator.



Type "TWO-1"
23 Kv, 250 MCM
(Outdoor Rating)

Type "TW-1"
5 Kv, 250 MCM
(Indoor Rating)

DELTA-STAR ELECTRIC COMPANY

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CANADIAN ASSOCIATE
Canadian Line Materials Limited — Toronto 13, Canada

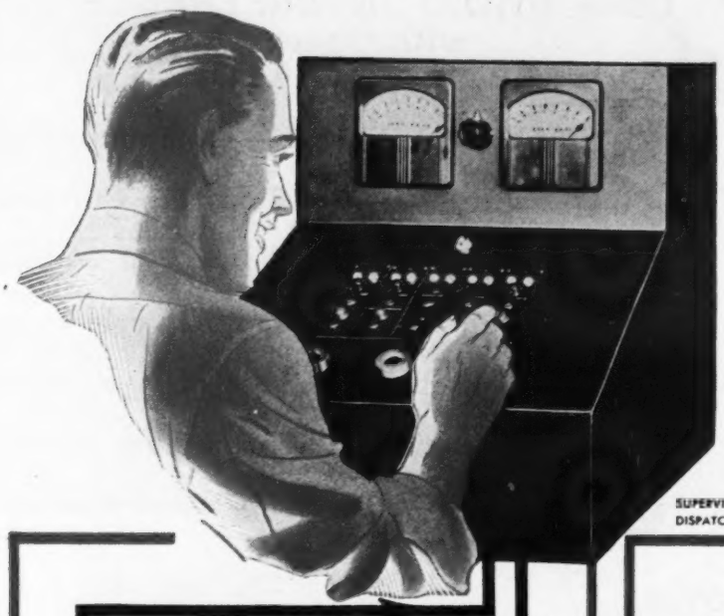
FOR ACCURATE REMOTE CONTROL AND SUPERVISION

...investigate the advantages of Carrier Supervisory Control

Time is vital when faults occur on power lines serving essential industries. Service must be restored with the greatest possible speed. This may require switching of apparatus in remotely located generating, transformation or conversion stations.

Supervisory control, using carrier channels, has proved the most efficient means of performing this function over long distances. It provides the highest degree of speed and reliability.

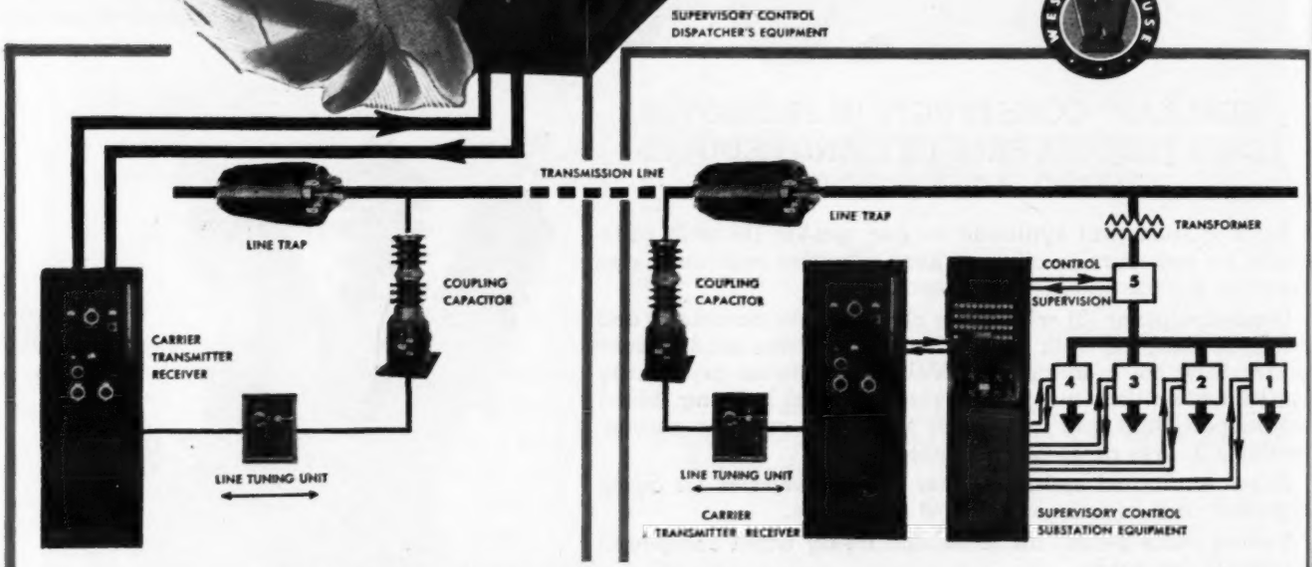
Westinghouse engineers have gained wide experience in applying supervisory control to meet special needs. This service is as near as your Westinghouse office. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. J-95088



Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Electronics at Work



BASIC ELEMENTS OF CARRIER SUPERVISORY CONTROL

AT THE DISPATCHING END:

Dispatchers Equipment: An assembly of control switches and indicating lights for devices to be controlled . . . and coding relays that key the carrier transmitter or respond to a received code for selecting points for control. Also for performing close trip or supervision functions.

Carrier Current Transmitter-Receiver . . . generates and receives carrier when actuated by the supervisory equipment.

Line Tuning Unit which cancels the impedance of the coupling capacitor.

Coupling Capacitor—through which carrier current flows into or out of the line.

AT THE SUBSTATION END:

Coupling Capacitor—through which carrier current flows into or out of line.

Line Tuning Unit which cancels the impedance of the coupling capacitor.

Carrier Current Transmitter-Receiver—generates and receives carrier when actuated by the supervisory equipment.

Supervisory Control Substation Equipment—responds to the received code to select the device to be controlled, and perform the proper control action.

FROM EXACT PROPERTIES TO FINISHED PARTS

PANELYTE* CAN BE MADE TO YOUR ORDER

PROPERTIES

PANELYTE properties are listed below—not as descriptive of any one grade of these paper, fabric, wood veneer, fibre glass, and asbestos base thermo-setting plastics—but to show the range of properties of the 32 grades.

HIGH DIELECTRIC STRENGTH

Volts/Mil. Short Time Test, ⅛" Thickness—up to 700 volts.
Dielectric Constant, at Radio Frequency (1 megacycle from 6 to 5 for electrical controlled grades)
Power Factor, at Radio Frequency (1 megacycle from 6.5% to 2.5% for electrical grades)

UNUSUAL STRUCTURAL STRENGTH

Izod Impact Strength (ft. lbs. per inch of notch)—0.5 to 20.
Compressive Strength (psi)—20,000 to 55,000.
Tensile Strength (psi)—7,000 to 35,000.
Modulus of elasticity in tension (psi x 10^5)—7 to 30.
Flexural Strength (psi)—12,000 to 40,000.

EASY MACHINABILITY

May be Sawed, Die Punched, Drilled, Lathe Turned, Milled, Knurled, Grooved, or Shaved.

LIGHT WEIGHT

20 Cubic Inches Per Pound—Half Weight of Aluminum.

LOW WATER ABSORPTION

As low as 0.7% in 24 hrs. immersion.

CORROSION RESISTANT

Not affected by Water, Brine, Oil, Ordinary Solvents, Coolants, Ketones, Esters, Most Acids and Weak Alkalies.

LOW COEFFICIENT OF FRICTION

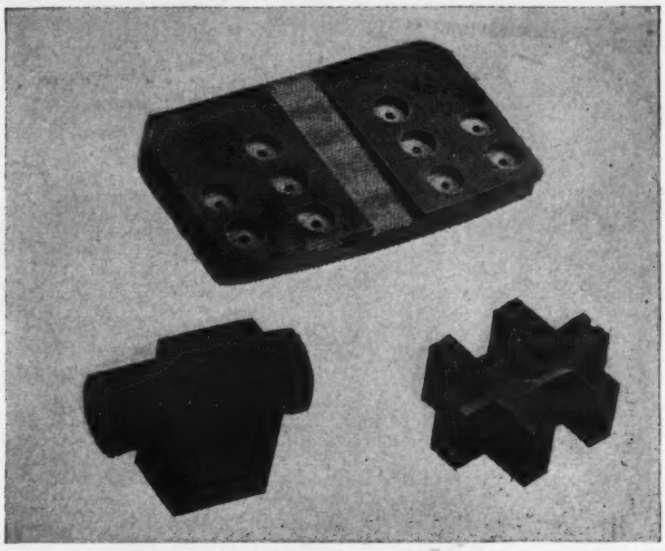
LOW THERMAL CONDUCTIVITY

GOOD DIMENSIONAL STABILITY

Low Cold Flow—Uniform Thermal Expansion—Does Not Warp Under Normal Conditions.

EXCELLENT HEAT RESISTANCE

Heat Resistance—300° F. for cellulosic base; inorganic base materials are flame resistant.—Does Not Soften Under Heat.—Only Effect of Hot Water to Accelerate Absorption.



Panelyte, the structural laminated plastic, is both versatile and adaptable. Close tolerance work is possible because sheets are thoroughly bonded and the structure homogeneous. Irregularity of shape or intricacy of design are not obstacles, as parts are lathe turned, milled or drilled to exact specifications.

Use Panelyte Service to eliminate time-wasting experiment — to improve your product or simplify its assembly — to save weight — to speed production. Your inquiry is invited on any problem involving the use of structural, laminated, resinous plastics in essential work.

Write for Data Sheets and samples.

PANELYTE *the structural plastic*

PANELYTE DIVISION
ST. REGIS PAPER COMPANY
230 PARK AVENUE
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Sales Offices: Atlanta, Boston, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Kansas City, Los Angeles, Montreal, New Orleans, St. Louis, St. Paul, San Francisco, Seattle, Syracuse, Toronto, Trenton, Vancouver

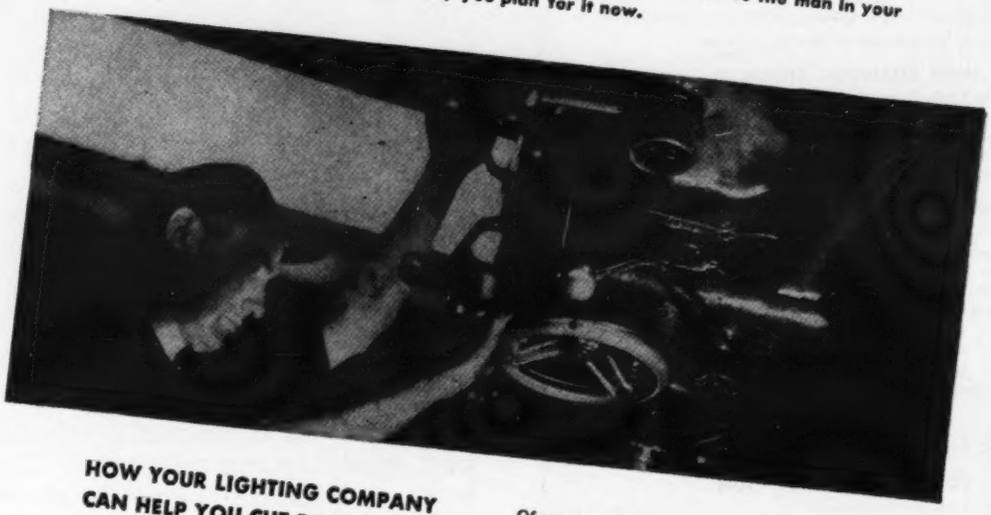
* MASS PRODUCTION OF SHEETS, RODS, TUBES, MOLDED FORMS, FABRICATED PARTS

Why is Jones better than Smith?

ON YOUR POSTWAR PAYROLL will be two men—let's call them Tom Jones and Fred Smith. They will do identical work. They will receive identical pay. Yet Jones will be better than Smith—produce better, faster, at lower cost. Why?

Because Smith is "weather-sensitive". Summer heat and humidity slow him up. Industry knows the answer—and so do you. It's comfort air conditioning —*and the figures are available on what it promises for lower postwar costs.*

Don't dismiss it as a fad. Your competitors aren't. Talk to the man in your town who is ready to help you plan for it now.



HOW YOUR LIGHTING COMPANY CAN HELP YOU CUT POSTWAR COSTS

Right in your city is an engineer-representative of your local utility who has the facts on comfort air conditioning . . . who can help you plan now to make all your employees produce to Tom Jones' level!

Postwar employee relations as well as postwar profits hang in the balance! For air conditioning can influence both—and it is not too early today to find out what it can do for your particular plant—and get it on paper!

Of course your electric company has something to sell. And so has Roebling. When the day comes that electric power takes over the job of filling your plant with year-round, high-efficiency climate, remember Roebling as *wire specialists* who are a logical source of supply for the wires and cables modernization will call for. For air conditioning. Better lighting. Better power distribution to your plant's work. Full utilization of all of the electric and electronic cost-cutters the war has evolved.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON 2, NEW JERSEY
Branches and Warehouses in Principal Cities

ROEBLING
PACEMAKER IN WIRE PRODUCTS

Wire Rope and Strand • Fittings • Cold Rolled Strip • Aircord, Swaged Terminals and Assemblies • Round and Shaped Wire Wire Cloth and Netting • High and Low Carbon Acid and Basic Open Hearth Steels Suspension Bridges and Cables • Electrical Wires and Cables • Aerial Wire Rope Systems

THIS ADVERTISEMENT is appearing in current issues of *Mill & Factory* and *Purchasing*, carrying this air conditioning message to 39,569 industrial executives. When industrial load building becomes a problem again, we hope that you will benefit from this and other messages which Roebling advertising brings before many branches of industry, month after month.

Full size reprints of the advertisement available on request

NEW O.Z. DATA FOR PRACTICAL PLANNERS

144 PAGE CATALOG PACKED WITH FACTS *About* FITTINGS

based on 25 years of "Know-How"

Here's an easy-to-use working tool for everyone whose future plans call for electrical fittings. Here are the results of wide pre-war experience seasoned and tested under war-time service conditions . . . the *facts* you need to know about an improved line of O.Z. products including the latest O.Z. developments in

- CONDUIT FITTINGS
- SOLDERLESS CONNECTORS
- CABLE TERMINATORS
- POWER CONNECTORS
- JUNCTION BOXES
- GROUNDING DEVICES

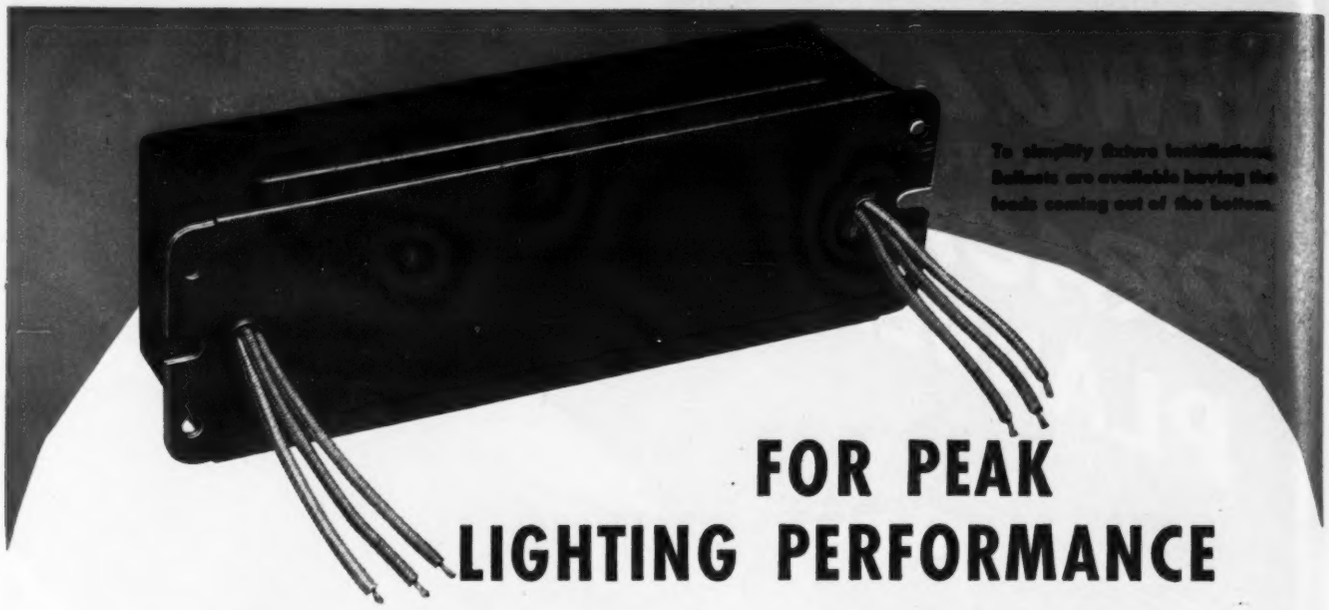
NOTE THESE FEATURES ADDED FOR YOUR CONVENIENCE

ENGINEERING TABLES
COMPLETE DIMENSIONS
FLAT OPENING PLASTIC BINDING
NEW PHOTO-DIAGRAMS
THREE-WAY INDEX—PICTURES, PRODUCT, CATALOG NUMBER

This new catalog gives you timely information in practical form, covering improved products, expanded lines, newly developed lines and reduced list prices. A request on your letterhead will bring you your free copy.

5248

O.Z. ELECTRICAL MFG. CO.
262 BOND STREET · BROOKLYN, N. Y.
REPRESENTATIVES IN PRINCIPAL CITIES



To simplify fixture installations, Ballasts are available having the leads coming out of the bottom.

FOR PEAK LIGHTING PERFORMANCE

● The satisfactory performance of fluorescent lighting depends to a great extent on the Ballasts,—and at Jefferson Electric the importance of this unit is well recognized,—and design, selection of all materials, construction and expert craftsmanship all contribute to the reliability for which transformers and ballasts bearing the Jefferson Electric mark have long been known.

Where groups of fluorescent lamps are installed, great savings in copper and other metals are possible by using Multi-Lamp type Ballasts. Costs are cut and installation time reduced. Four 100-watt lamps, for example, served by one Four-lamp Ballast saves 50 per cent of the cold rolled steel, silicon, and copper required for two two-lamp 100-watt Ballasts. Too, power losses are reduced, and since four-lamp Ballasts may be used on 250-280 volt circuits, conductors can be smaller than for 110-130 volt circuits, another saving of copper.

Jefferson engineers introduced Ballasts with bottom leads to facilitate installation on shallow wiring channels, available in the popular capacities,—two- and three-lamp 40-watt; two- and four-lamp 100-watts.

Write for Bulletin 421-FL which carries full data. Recommendations of our engineers are yours for the asking. . . JEFFERSON ELECTRIC COMPANY, Bellwood, (Suburb of Chicago) Illinois. Canadian Factory: 60-64 Osler Avenue, West Toronto, Ontario.

JEFFERSON ELECTRIC

CERTIFIED E·T·L SPEC NO 6 HIGH P.F.

UL

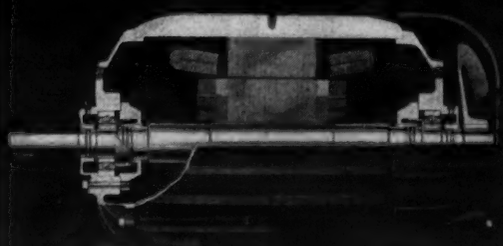
BALLASTS

For Fluorescent Lighting

Distributed through wholesalers

FOR

Sulphur & Sulphuric Acid Handling Plants
Rubber Mills
Cotton Mills & Gins
Lime Kilns
Sugar Refining
Aluminum Plants
Turpentine & Rosin Plants
Tanneries
Drug Manufacturing
Paint & Varnish Plants
Breweries
Ceramics Plants
Food Processing
Fertilizer Handling
Cement Mills
Oil and Fat Recovery
Flour Mills



CROCKER-WHEELER Motors-Generators

SEALEDPOWER
(Cowl-cooled) . . . available for all polyphase alternating current circuits, 2 to 15 horsepower. Write for detailed literature, or call our nearest office.

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Feed Mills
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Now a Corrosion-Resistant *SEALEDPOWER* Motor

PROTECTED AGAINST: acid fumes, alkali fumes, splashing or dripping corrosive liquids, air-borne moisture, steam, corrosive gases, conducting dusts, metallic chips, etc.

PROTECTED BY: a corrosion-resistant frame, cooled by a built-in corrosion-resistant fan. The windings are *doubly* protected from damage by Crocker-Wheeler's vacuum-impregnation process which seals *each* coil individually against moisture, fumes or dirt.

BRUTALLY TESTED! The seal's effectiveness is proved by laboratory tests (at right) and by hundreds of satisfactory installations.

1 SEALEDPOWER motor was placed in tank containing several inches of water and run continuously for 8 hours (see photo). It stood idle in water overnight, then was run 8 more hours. During motor's operation, the external ventilating fan drenched the outside of the frame with water. At end of test, the motor was disassembled and found to be *completely dry* inside.

2 A dense atmosphere of extremely fine French chalk was kept circulating around the motor and through its ventilating system for many hours. No trace of chalk was found inside upon disassembly.

JOSHUA HENDY IRON WORKS

CROCKER-WHEELER DIVISION

ESTABLISHED 1856

AMPERE, NEW JERSEY

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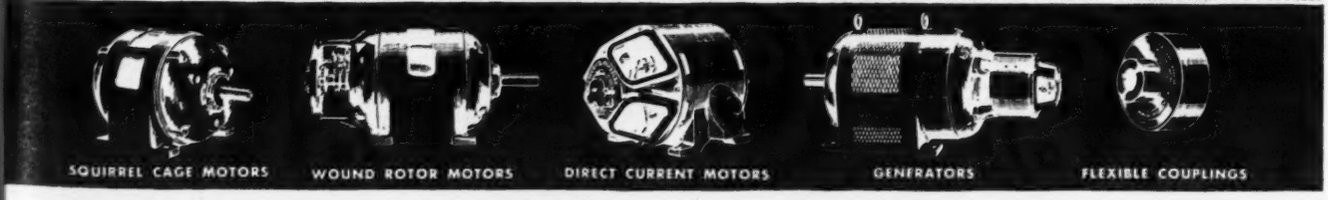


SQUIRREL CAGE MOTORS | WOUND ROTOR MOTORS | DIRECT CURRENT MOTORS | GENERATORS | FLEXIBLE COUPLINGS

Scovill Tube News

Vol. 2 SCOVILL MANUFACTURING COMPANY, Waterbury 91, Conn. No. 3

Condenser Tube Installation Methods and Their Influence on Tube Life

Scovill engineers discuss the proper controls to prevent the most common troubles

The importance of proper tube installation in tubular heat exchangers has been repeatedly demonstrated both for new equipment and for retubing. Tube life and tube sheet life frequently have been shortened by the lack of proper control over the installation method. Distorted and cracked tube sheets; corroded, split, and cracked tubes — all have resulted from excessive or improper rolling or joint design.

As the importance of installation methods has become generally recognized, various controls have been developed to prevent excessive rolling — the most commonly encountered fault: —

1. Tubular "stops" are placed on the expander mandrel behind the carriage to prevent mandrel entrance beyond the desired point.
2. Limited pneumatic pressure is used for the operation of expander air motors.
3. Expanders are available fitted with cylindrical rolls, and with mandrels tapered in front and cylindrical at back. Tapered section of mandrel expands tube the desired amount, after which rolls slide over into cylindrical section of the mandrel and do no further work.

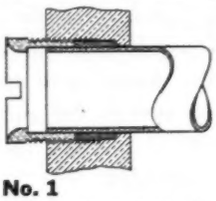
These and other methods are successfully used for *control* which is one of the primary requirements.

Scovill's tube engineers always have recognized the importance of proper installation on tube and unit life and have pioneered many of the improved tools and methods.

Since the tubular "stop" on the expander mandrel — as a means for controlling expansion — is simple, positive, applicable to all standard expanders, and calls for no specialized equipment, it has been used and widely recommended by us.

The following eight illustrations show methods of installation, and give a brief explanation of the advantages or disadvantages of each. More complete information is contained in "Scovill Condenser Tubes", a new edition of which will shortly be available.

Detail data given is authoritative for nonferrous tubes of common condenser tube sizes only (⅝" to 1¼" O.D. and 14 (.083") to 18 (.049") Ga.), but many of the details and practically all of the principles can and should be applied to other sizes and materials.

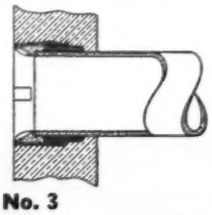


Method No. 1

Formerly the usual method of installing tubes in marine and stationary steam condensers. Inferior because of:

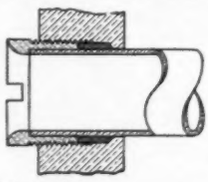
A. Protrusion into water box to create turbulence.

B. Pocket between inside shoulder of ferrule and tube end.



Method No. 3

This "flush-type ferrule"* can be installed as easily as the regular projecting type, but with this method, no inlet end air pocket is formed; and as there are no projections into the water box, turbulence is kept to a minimum.



Method No. 2

Where protruding inlet end ferrules must be used, install as shown with the tube end fitted snugly into ferrule shoulder. Allow for expansion at the outlet end.

Method No. 4

Recommended for renewing old tube sheets originally using ferrules. For this method a special bushing is inserted to replace the ferrule. The bushing is then reamed, radius cut, and grooved, after which the tube is expanded, flared, and beaded into position. See notes I, II, IV, V, VIII.

**Patented*

NOTES

I — Air entrained in the circulating water, or released from solution by turbulence or low pressure areas, frequently has a destructive effect on tubes. Streamlining of tube inlet ends reduces turbulence and minimizes the release of air from solution. This is of vital importance in steam condensers.

In oil refinery heat exchanger units, often operated under pressure, velocities are commonly so low, and impingement attack so uncommon, that tubes are satisfactorily installed by expanding without flaring or beading.

II — Reamed hole tolerances should not exceed plus and minus .002".

III — Locating inlet end of tube and avoidance of creep during expansion — any one of several methods may be used.

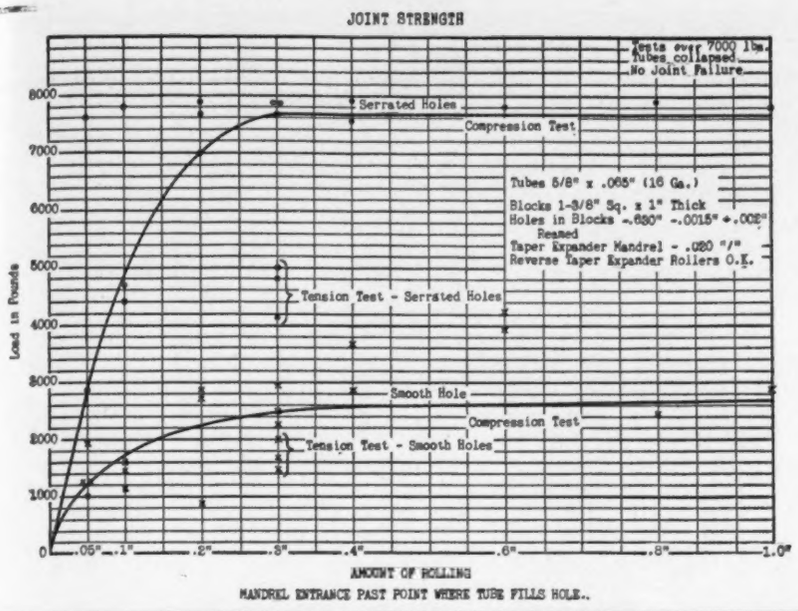
A. Scovill screw-in holding tool at outlet end, or Scovill combination tube puller and holder.

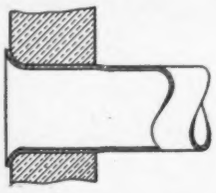
B. The outlet end, if to be expanded, may be rolled first, and the tube faced to length at the inlet end.

C. Expanders supplied by Scovill are recessed to receive the tube end and arranged to set the tube in the proper position where its location may be noted and held by a workman at the outlet end.

IV — Expanded length should extend through the tube sheet to prevent space between sheet and tube in which corrosive shell side media might collect, stagnate, and initiate active corrosion.

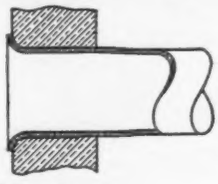
V — Expanded length should not extend beyond inner face of tube sheet, otherwise, an unsupported expanded section subject to stress corrosion or fatigue cracking will be created.





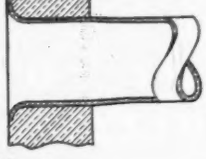
Method No. 5

Expanded to metal vs. metal joint with tube sheet. Tube sheet must be drilled, reamed, radius cut, after which the tube is expanded, flared, and beaded. This method is superior to methods No. 1 and No. 2. See notes I, II, III, IV, V.



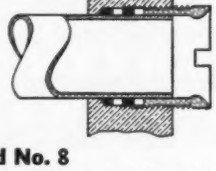
Method No. 6

In this method, the tube is expanded into a serrated hole which provides superior joint strength and permanence without excessive expansion. Tube sheet must be drilled, reamed, radius cut, grooved, after which the tube is expanded, flared, and beaded. See notes I, II, III, IV, V, VII, VIII.



Method No. 7

This is a refinement of method No. 6, but in method No. 7 the tube sheet has been recessed so that the beaded tube is flush with the tube sheet surface. This method requires that the tube sheet be drilled, reamed, radius cut, recessed, hole grooved, after which the tube is expanded, faced off to exact length if required, flared, and beaded. See notes I, II, III, IV, V, VII, VIII.



Method No. 8

This illustrates the use of Scovill's improved streamline ferrule for outlet end joints. It provides ample room for tube expansion, but the streamlined shoulder prevents the tube from dropping free of the inlet tube sheet. Although not illustrated, satisfactory outlet end joints can also be made without ferrules by the use of alternate rings of soft metal and fibre in the proper proportions.

VI — A short bevel or radius at inner face of tube sheet holes is recommended to minimize the potentially damaging effect of sharp edges against which vibration may occur and stresses concentrate.

VII — Allowance should be made for expansion and contraction of tubes due to thermal differentials in service. Various methods are used successfully.

A. Expansion joints in shell.

B. Floating heads (commonly used in small exchangers).

C. Bowed tubes — bow should be upward in order that tubes will drain when idle. This is frequently of great importance.

D. Tubes tight and fixed at inlet ends — pressure tight but free to slip at outlet ends (as with alternate rings of soft metal and fibre in proper proportions).

E. Tubes rolled at one end, then heated slightly over operating temperature and rolled at other end while hot. Tubes are then under slight tension when cold, but of proper length, and without stress while operating. The stress while idle has never, within Scovill's experience, caused trouble.

VIII — Serrated vs. smooth tube sheet holes. The advantage in joint strength obtained through the use of serrated tube sheet holes is clearly demonstrated in the chart in upper left corner.

TWO OTHER SCOVILL SERVICES —

The information in this article is illustrative of Scovill *Service in Manuals.* Other Scovill services welcomed by heat exchanger operators are *Service in Metals* — which means the facilities of our laboratories (as national needs permit) to help determine the best alloy for your conditions . . . and *Service in Men* — which means close cooperation from Scovill engineers in planning proper installation and in investigation where necessary.

For Scovill's new manual, advice on metals, or personal service of a Scovill engineer, address Scovill Manufacturing Co., 24 Mill St., Waterbury 91, Conn.

THIS IS NUMBER NINE in a Series of Scovill Advertisements to help you get longer life from condenser and heat exchanger tubes.

Scovill
MANUFACTURING COMPANY
WATERBURY, CONN.

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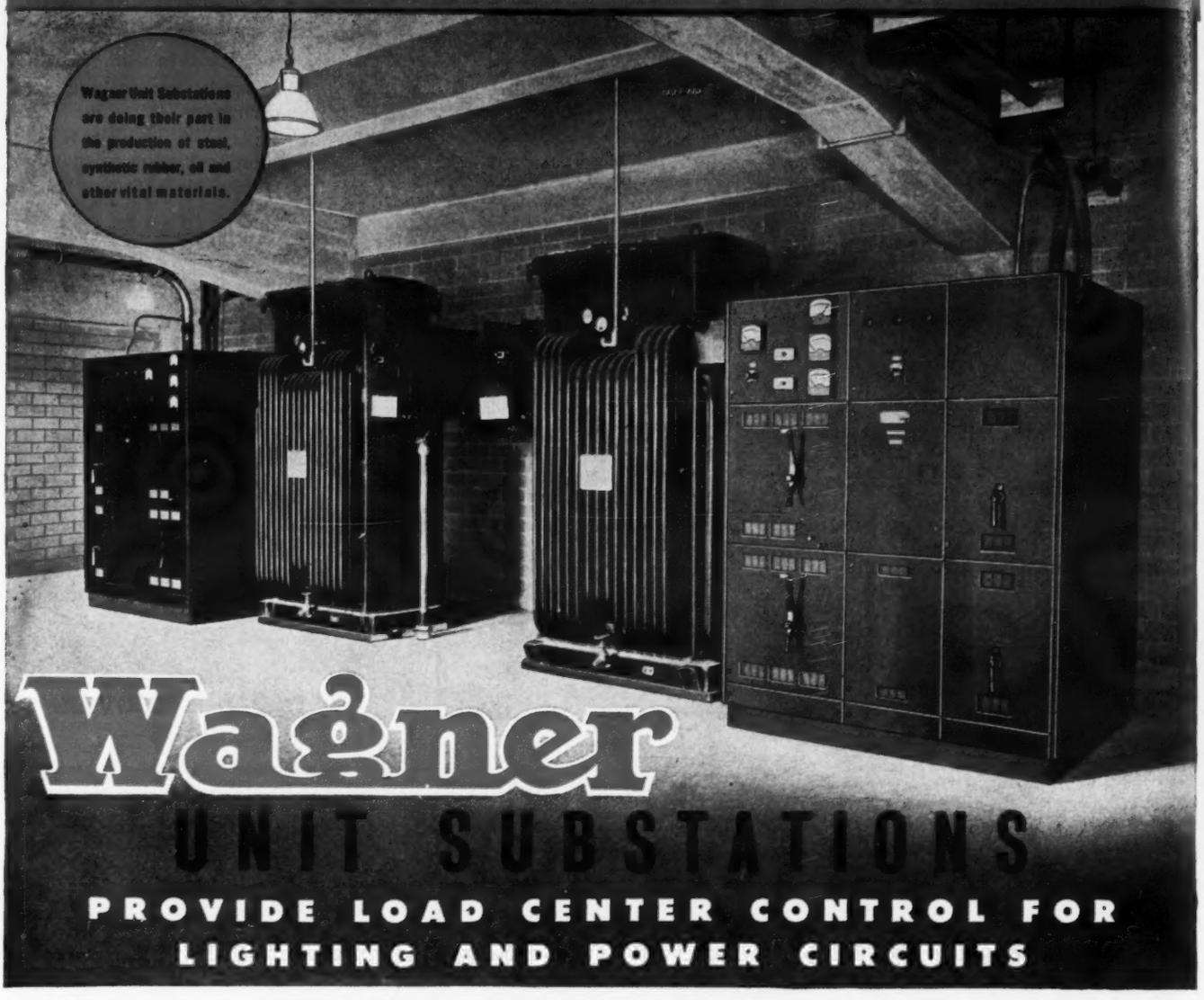
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The Unit illustrated above is installed in a synthetic rubber plant. Each transformer has a two-position liquid-filled disconnecting switch on the high-voltage side which is equipped with low-voltage interlock. The low-voltage side is equipped with air circuit breakers electrically or manually operated, ground indication lights, voltmeters, ammeters, and ammeter test blocks. Each unit has one main breaker, one tie transfer breaker, and two feeder breakers.

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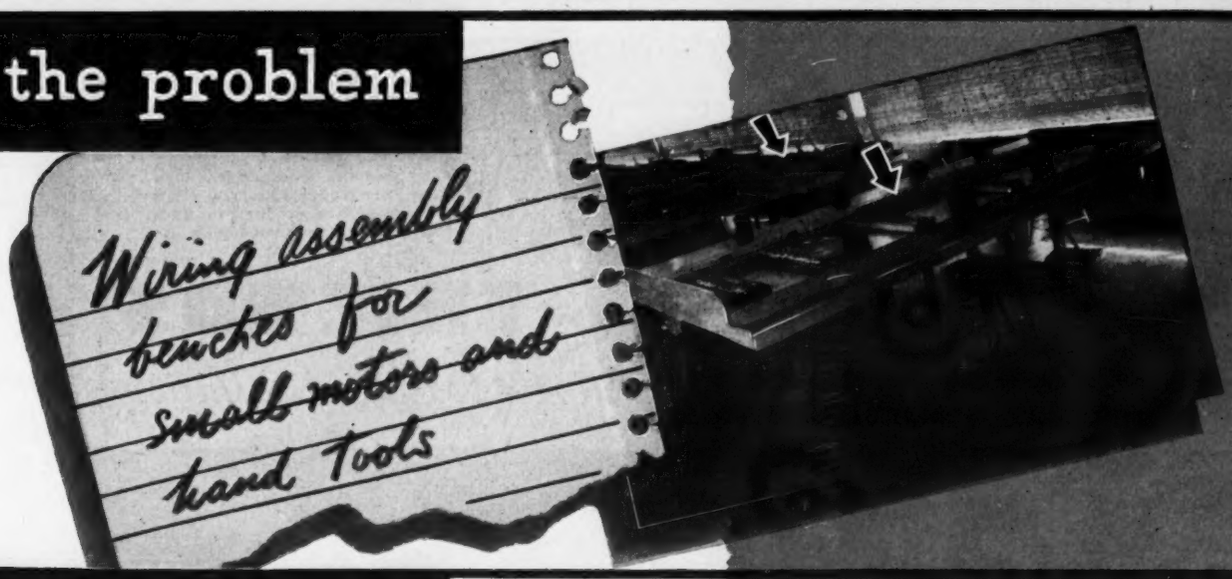
SYSTEMS DIVISION

REMINGTON RAND

Buffalo 3, New York

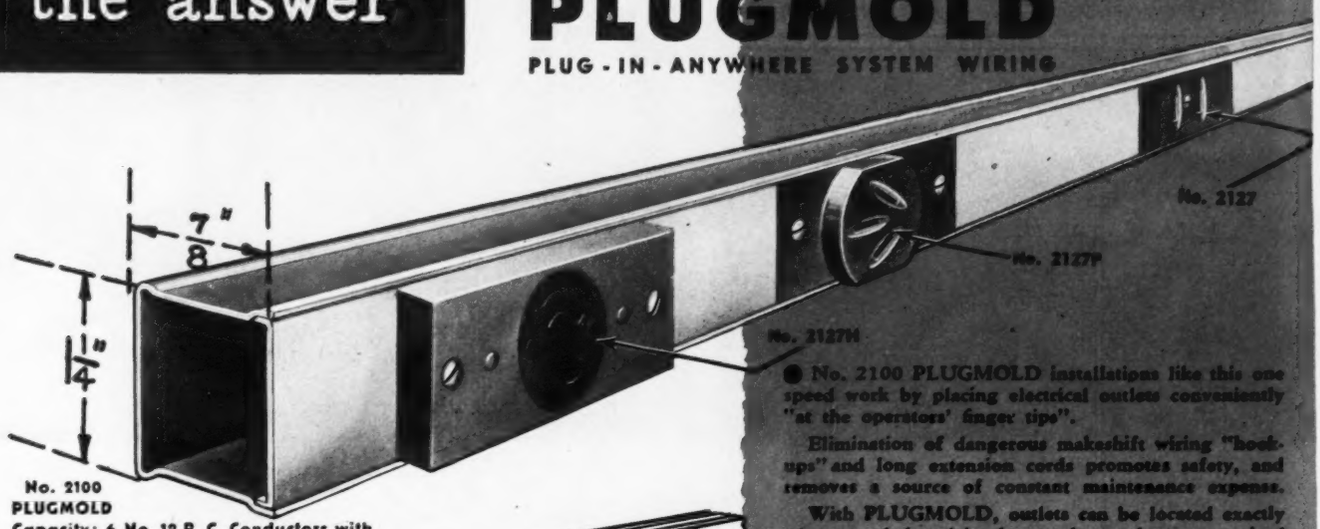
the problem



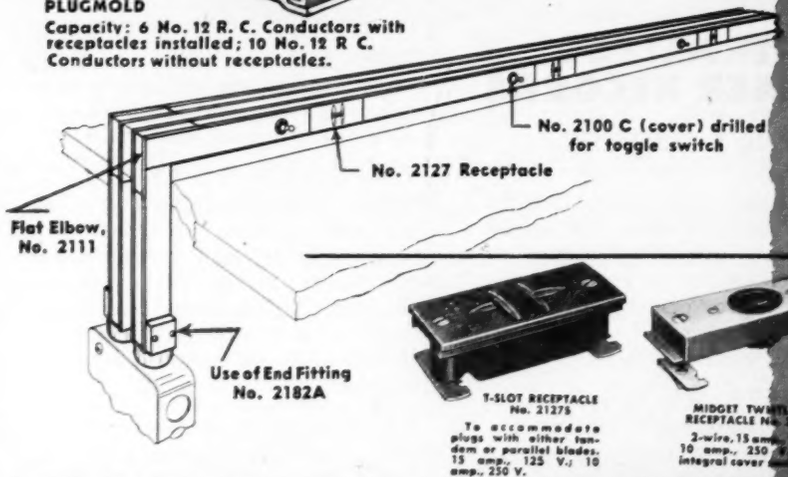
the answer

PLUGMOLD

PLUG-IN-ANYWHERE SYSTEM WIRING



No. 2100 PLUGMOLD
Capacity: 6 No. 12 R. C. Conductors with receptacles installed; 10 No. 12 R C. Conductors without receptacles.



● No. 2100 PLUGMOLD installations like this one speed work by placing electrical outlets conveniently "at the operators' finger tips".

Elimination of dangerous makeshift wiring "hook-ups" and long extension cords promotes safety, and removes a source of constant maintenance expense.

With PLUGMOLD, outlets can be located exactly where needed and in the number and types required for a specific application. Individual or group switch control may be arranged as shown.

No. 2100 PLUGMOLD Channel and Fittings are listed by Underwriters' Laboratories, Inc., and conform to Federal Specification W-R-32.

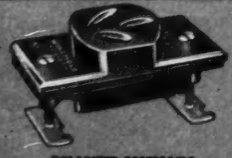
Available for immediate delivery on suitable priorities. Write for new Industrial Wiring Bulletin describing this and other Wiremold wiring systems.

T-SLOT RECEPTACLE No. 2127S

To accommodate plugs with either tandem or parallel blades. 15 amp., 125 V.; 10 amp., 250 V.

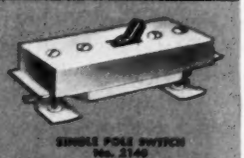
MIDGET TWISTLOCK RECEPTACLE No. 2127H

2-wire, 15 amp., 125 V.; 10 amp., 250 V. with integral cover



POLARIZED RECEPTACLE No. 2127P

3-wire receptacle for industrial use. 15 amp., 125 V.; 10 amp., 250 V.



SINGLE POLE SWITCH No. 2140

May be installed at any desired point to control individual outlets. 10 amp., 125 V.; 5 amp., 250 V.

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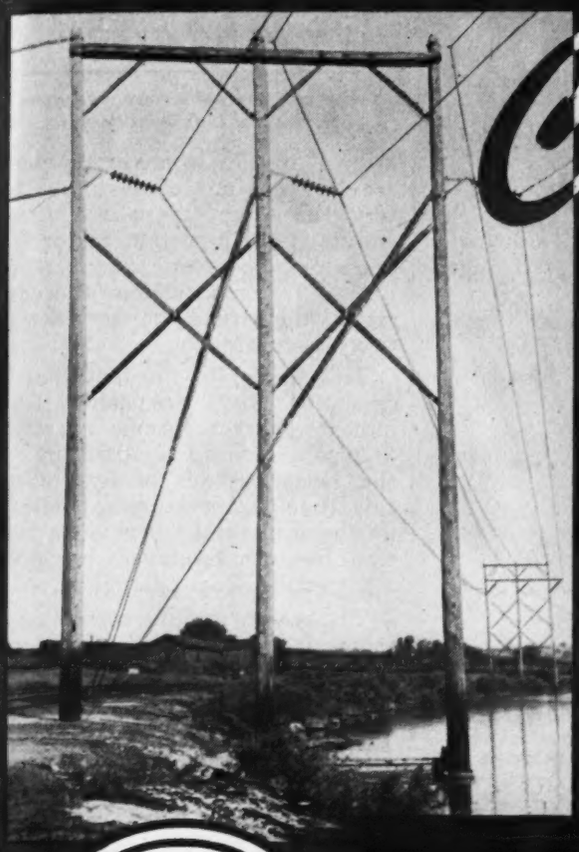


Complete SAPWOOD PROTECTION!

As Proved in the Laboratory

A Plus A'—Sapwood

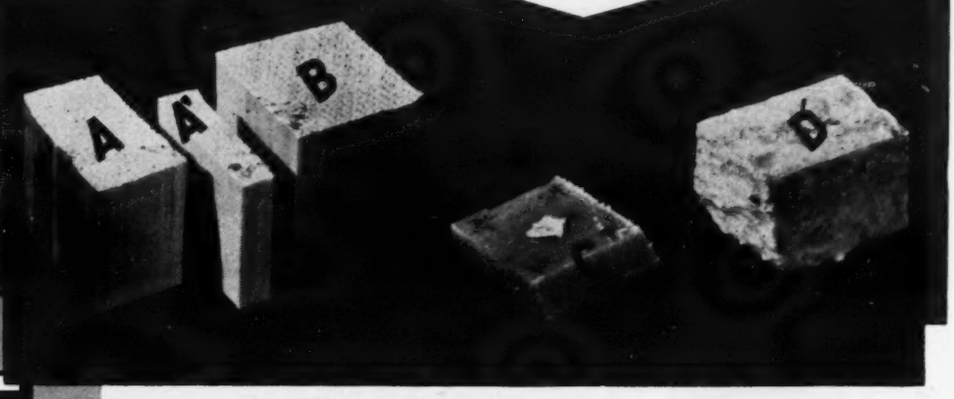
B—Heartwood

A—Outer sapwood initially treated.

A'—Inner sapwood initially untreated.

C—Culture of inner sapwood corresponding to A'. It was under intense decay conditions for three months. By diffusion and creep the 5% pentachlorophenol solution had permeated the entire sapwood making it decay proof. Chemical analysis also showed the presence of the preservative.

D—Untreated sapwood under same decay conditions as C was destroyed by decay in the same period of time.



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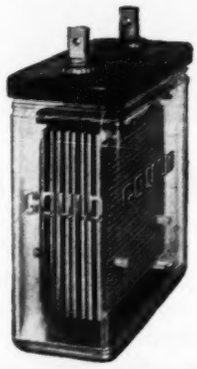

• Note the characteristic hook on the upper left corner of the Gould Plante plate pictured above. It is another exclusive feature that gives the Gould Plante battery a longer, useful life.

In the Gould Plante the far sides of both positive and negative groups have these hooks, which rest in hard rubber channels that are supported from the crossbar and plate assembly of opposite polarity. Thus each plate is fully supported at both ends.

This is the famous "Gould Dual Suspension", which is to be found only in Gould stationary batteries. While providing substantial support it allows the plates to hang freely. Plate growth due to normal battery operation merely extends the plate farther into the electrolyte. In this way it completely eliminates any chance of the misplacement or plate buckling that is a common fault of bottom-supported stationary cells.

Get all the facts on the Gould Plante. Ask for the Gould Sealed-in-Glass Bulletin, using business letterhead.

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Since 1898 THE BATTERY PICKED BY ENGINEERS

HOW TEMPERATURE AFFECTS SPECIFIC GRAVITY

One of a series of service suggestions for users of industrial batteries.

◀ In taking hydrometer, or specific gravity, readings of a storage battery the temperature of the electrolyte is an important factor. Few operators, however, take temperature into consideration and, as a result, their readings are not entirely accurate.

This is due to the fact that hydrometer floats are calibrated to indicate correct specific gravity at a certain definite temperature. On the better grades of hydrometers this base temperature is indicated on the scale, and whenever a variation from this temperature occurs a correction must be applied.

The reason for this correction lies in the fact that specific gravity is a relative term. Strictly speaking it is the density, or weight, of a liquid as compared to an equal volume of pure water at 4° Centigrade. This is much too cold for ordinary use so hydrometer scales are usually calibrated at 25° / C. 25° C., which means that the scale has been adjusted to compare the specific gravity of the electrolyte to a similar volume of pure water when both have a temperature of 25° Centigrade, or about 80° Fahrenheit.

When there is any change in the temperature of the electrolyte from this basic 80° F., it means that you are trying to compare the specific gravity of one solution at a certain temperature to another at a second and different temperature. This is beyond the capabilities of the hydrometer and corrections must be made.

This temperature correction is easy to apply. Just remember that when the temperature is high, the electrolyte has expanded and is not so dense as before. This causes the hydrometer float to ride low and give readings higher than the true reading. Conversely, when the electrolyte is cold the float rides high and gives figures that will err the other way.

To make these corrections add or subtract 3 points of "gravity" (.003) for each 10° F. change in temperature—battery temperature, *not* air temperature. The calibrated point is 80° F. If the temperature is 10° F. above 80° F., add. If below, subtract. Example: A hydrometer reading of 1.250 at 90° F. is really a hydrometer reading of 1.250 plus .003 or 1.253. *(Advertisement)*

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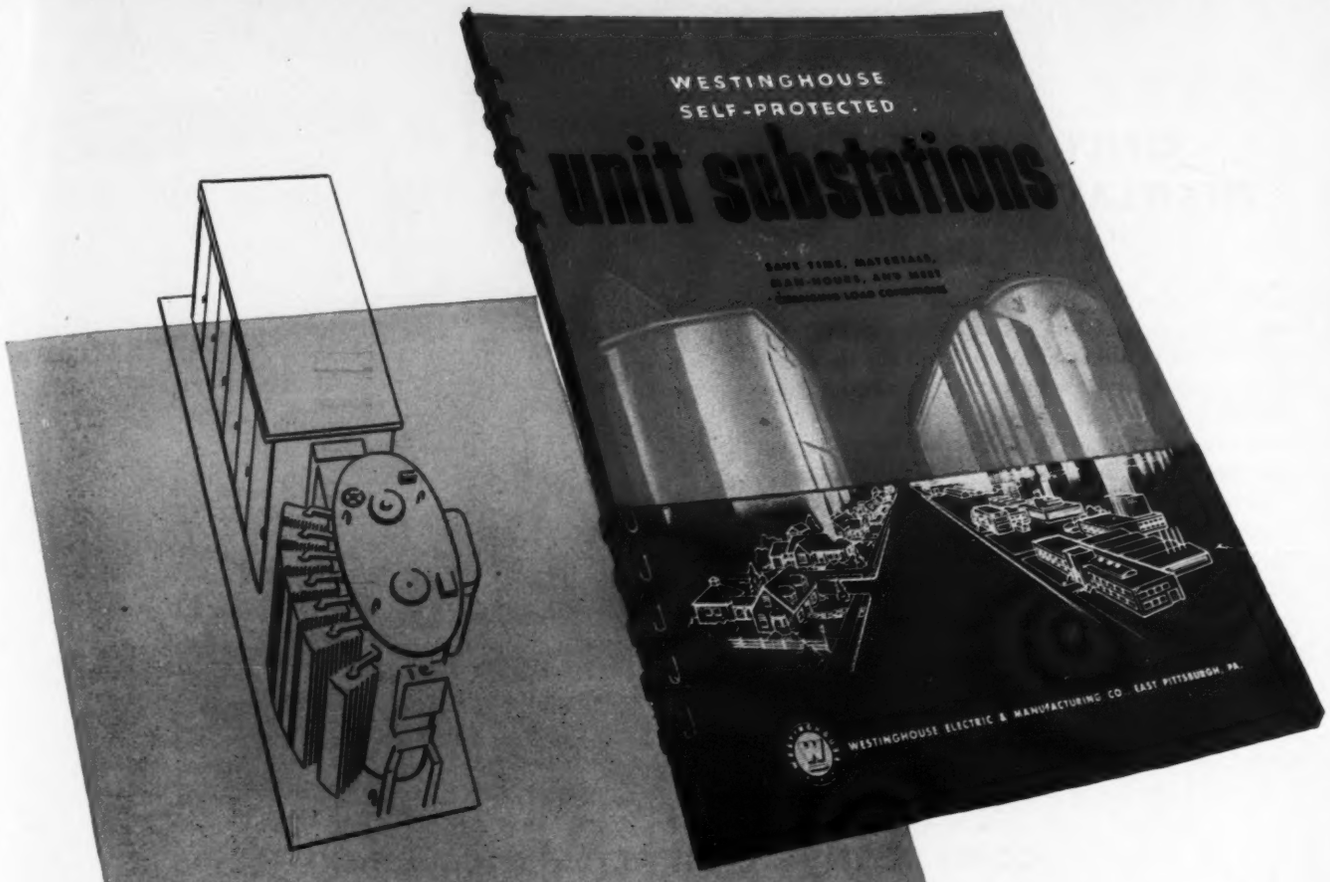
MOVABLE POWER FOR RECONVERSION!



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- PORTABLE SUBSTATIONS

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The bulletin illustrates the timesaving accessibility of every part and shows how Westinghouse Unit Substations combine, better than any other substation, voltage regulation, service continuity, flexibility, efficiency and safety.

Specification guides, section views, ratings, weights and dimensions in this book place at your finger tips information you need to help you plan for today's needs and tomorrow's reconversion.

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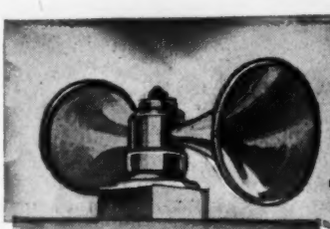
Westinghouse unit substations

J-97084

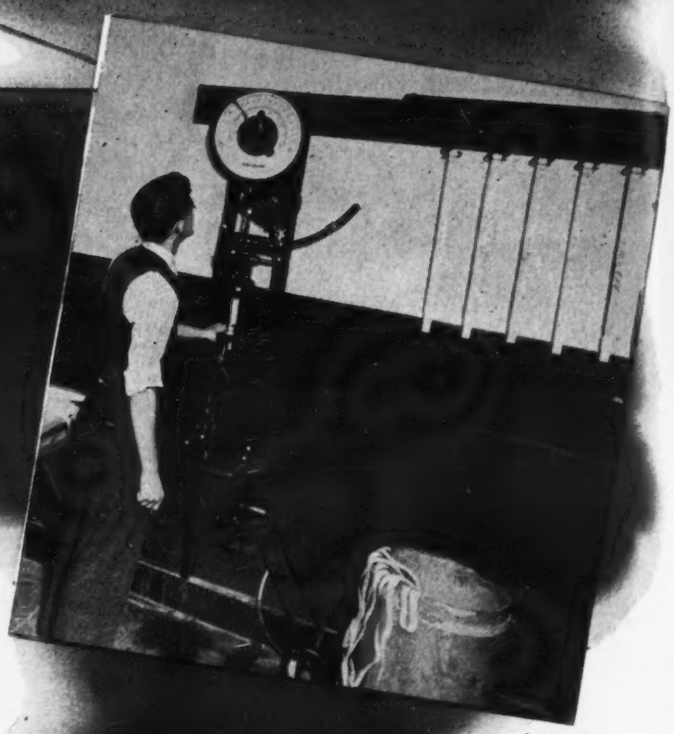


13 "ALERTS" TEST IRVINGTON VARNISHED CAMBRIC

ONLY QUALIFIED INSULATION GETS THE "ALL CLEAR"

In the production of Irvington Varnished Cambric and Tape, laboratory technicians are ever "on the alert" to maintain Irvington's high standards for electrical insulation. Raw fabric and finished products are regularly subjected to a series of 13 exacting tests. Only after passing all these tests are varnished cambric and tape given the "All Clear" for shipment.

Carefully and constantly checked are the following: Construction, purity, and bursting strength of the base cloth; uniformity of thickness, elongation, and tensile strength of both base and varnished fabric; dielectric strength, tear strength, and resistance to heat and hot oil of finished cambric and tape. The severity of these tests, plus manufacturer's control of varnish formulation, is your assurance of better and longer lasting insulation—of quality that has brought confident, growing use of Irvington Varnished Cambric and Tape for over 38 years.



Sensitive load of base cloth [illegible] measured on a Scott Tensile Tester. Strips at right are being checked for [illegible] and elasticity.

COMPARATIVE CHARACTERISTICS CHART

	Black Straight Cut Var. Cambric & Tape	Yellow Straight Cut Var. Cambric & Tape	Black Seamless Bias Var. Cambric & Tape	Yellow Seamless Bias Var. Cambric & Tape
Applications	For hand or machine taping of straight, even surfaces		For hand or machine taping of irregular surfaces and contours	
General Properties	Resistant to abrasion, aging, heat, water, acid and alkalies; smooth and flexible.			
Special Properties	Resistant to lubricating oil	Resistant to insulating oil	Resistant to lubricating oil Elongation — — 1.7% @ 20 deg. C. (.010" Th.)	Resistant to insulating oil Elongation — — 1.5% @ 20 deg. C. (.010" Th.)
Dielectric Strength (.010" thickness) volts per mil	1050	950	As received — 1000 After elongation — 800	As received — 900 After elongation — 575
Tensile Strength (.010" thickness) — lbs. per 1" width	40	38	38	35
Indicated Uses	On corners and between layers of field coils; for phase insulation of stators; as slot insulation; and for overall coil wrappings	For wrapping small coils and coil forms, as insulation between windings of ignition, magneto and transformer coils, as slot, end winding and phase insulation.	Where tight, smooth lap winding is required as on armature and field coils; for bus bar and terminal insulation; for taping cable joints and connections.	Especially suitable for transformer and other coils which operate in insulating oil, armature, field and other coils involving angles and bends.

For additional information or samples, write Dept. 46

IRVINGTON VARNISH & INSULATOR CO.
Irvington, New Jersey, U.S.A.
***Plants at* Irvington, N. J. *and* Hamilton, Ontario, Canada**

IRVINGTON *Electrical* INSULATION

Just one flat glass surface to wash.
BENJAMIN
Cover clamps are easily opened without tools.
Benjamin "Type II-G" Sealed Flo 48" units are listed by Underwriters' Laboratories for Class II, Group F and G, III and IV hazardous locations. Available in twin and triple-lamp units, with plain or impact resisting cover glass.
Cover hangs straight down for easy servicing.

Specify Benjamin SEALED-FLO *Fluorescent* LIGHTING UNITS

✓ ***For More Light*** *in departments with adverse atmospheric conditions*

✓ ***For More Easily Sustained High Lighting Levels***

✓ ***For Simplified Maintenance***

To secure the advantages of fluorescent lighting where combustible dusts in the atmosphere may create fire and explosion hazards and where maintenance due to dirt and vapor is a problem, specify Benjamin Type II-G "Sealed-Flo 48" units.

Dust-Tight and Vapor-Tight

These extremely durable, porcelain enamel fixtures, with their one-piece steel reflector and special type glass cover seal the interior against dust and dampness. All that is required to maintain the rated output of these units is cleaning the cover glass and re-lamping when needed. Exclusive Benjamin constructions embodied in these units reduce maintenance time to a minimum. Cover clamps are easily opened by hand; hinged cover facilitates re-lamping.

High Lighting Efficiency

In general lighting installations, Twin-Lamp Sealed-Flo units provide lighting levels ranging from 20 to 48 footcandles at normal mounting and spacing. Triple-lamp units provide approximately 28 to 65 footcandles. These units are also widely employed for local lighting of inspection tables, production lines and machines. Twin-Lamp units provide up to 100 footcandles and Triple-Lamp units up to 135 footcandles for such applications.

Listed by Underwriters' Laboratories for Certain Locations Requiring Dust-Tight or Vapor-Tight Lighting Units

These units satisfy all Underwriters' requirements for Class II, Group F and G hazardous locations, Class III and IV locations. They are available on the same priorities as other industrial fluorescent and incandescent equipment. For further details and complete data on these units

Write for free Data Bulletin today

Benjamin Electric Mfg. Co.

Product Information Department K, Des Plaines, Illinois

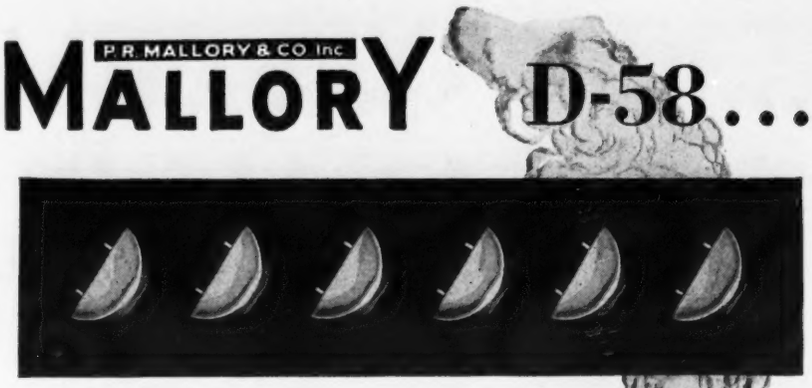
BENJAMIN TRADE MARK

Lighting Equipment

DISTRIBUTED EXCLUSIVELY THROUGH ELECTRICAL WHOLESALERS

P. R. MALLORY & CO. Inc.

MALLORY D-58...



Formula for Clipping Enemy Wings

The eyes and ears of Uncle Sam's anti-aircraft guns are contained in an elaborate electrical control apparatus that follows and aims at fast-moving targets. That apparatus must be accurate to the nth degree—and, of course, it is.

To obtain such accuracy, the manufacturer of this "electrical bird dog" consulted Mallory. For when it came to selecting the right metal for the sliding contacts, he knew that Mallory experience would serve him well.

It did—and it does. Today, Mallory D-58—an alloy with unusual metallurgical properties and excellent electrical conductivity—is helping to bring down enemy war birds all over the world. It operates smoothly and efficiently with a minimum of resistance. It has a slow rate of wear, and it can stand the gaff over protracted periods.

When you are designing relays, circuits, or any other electrical equipment requiring contacts of long life and high efficiency, Mallory "know how" can be of tremendous assistance. Bring your problems while the work is still on the drawing board. Here, competent metallurgists will quickly analyze your requirements...recommend the right kind of alloy for the right kind of contact . . . answer your questions with accuracy and speed. Consult Mallory.

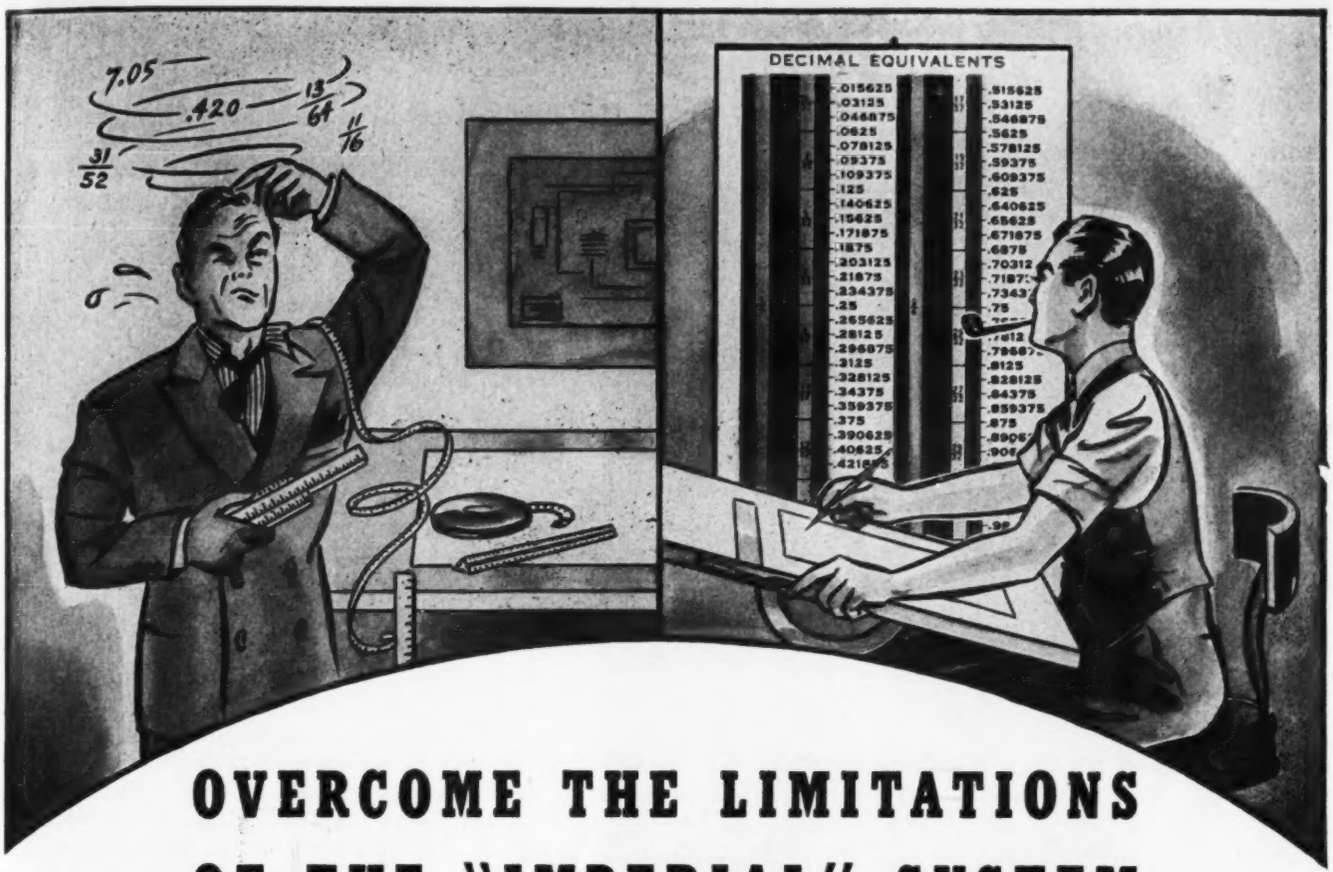
P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

ARMY E NAVY

Buy More War Bonds

ELECTRICAL CONTACTS AND CONTACT ASSEMBLIES
NON FERROUS ALLOYS, POWDERED METAL PARTS

How do YOU *do it?*



OVERCOME THE LIMITATIONS OF THE "IMPERIAL" SYSTEM

- The "IMPERIAL" is the customary system of measurement used in the British Empire and in the U. S. A.

  From the beginning of time, man has striven to unify and simplify his measurements.

- The "CUBIT" . . . oldest known measure of length, varied, but averaged 21.8" . . . Egypt had 3 different cubits, 17" for the common man, 21" for the King, and 35" for the Sanctuary.

- The "FOOT" . . . originated in Greece . . . became the standard unit of length in the early Olympic Games . . . reputed to be the length of Hercules' foot. Romans based their system upon the Greek method, and forced their Romanized code of measurement upon England. When Britain was again free, this Roman-Greek system was modified . . . and thus started the "IMPERIAL" system.

- The "YARD" . . . originally the circumference of a man's body, later the length of the first King Henry's arm . . . still later became a multiple of the foot

- The "INCH" . . . the length of 3 barley corns . . . later became 1/12th of a foot.

- THE LIMITATIONS ARE THAT THESE UNITS ARE NOT MULTIPLES OR UNITS OF DECIMALS.

  Modern Engineering and Manufacturing demand flexible and precise standards . . . hence the use of Decimal Equivalents.

  Time will not permit individual interpolations.

- The CONTINENTAL-DIAMOND Decimal Equivalent Chart is an indispensable aid to crash through the limitations of the "IMPERIAL" system . . . in colors . . . 23" x 35" . . . easily read . . . gives Decimal Equivalents from 1/64th" to 64/64"

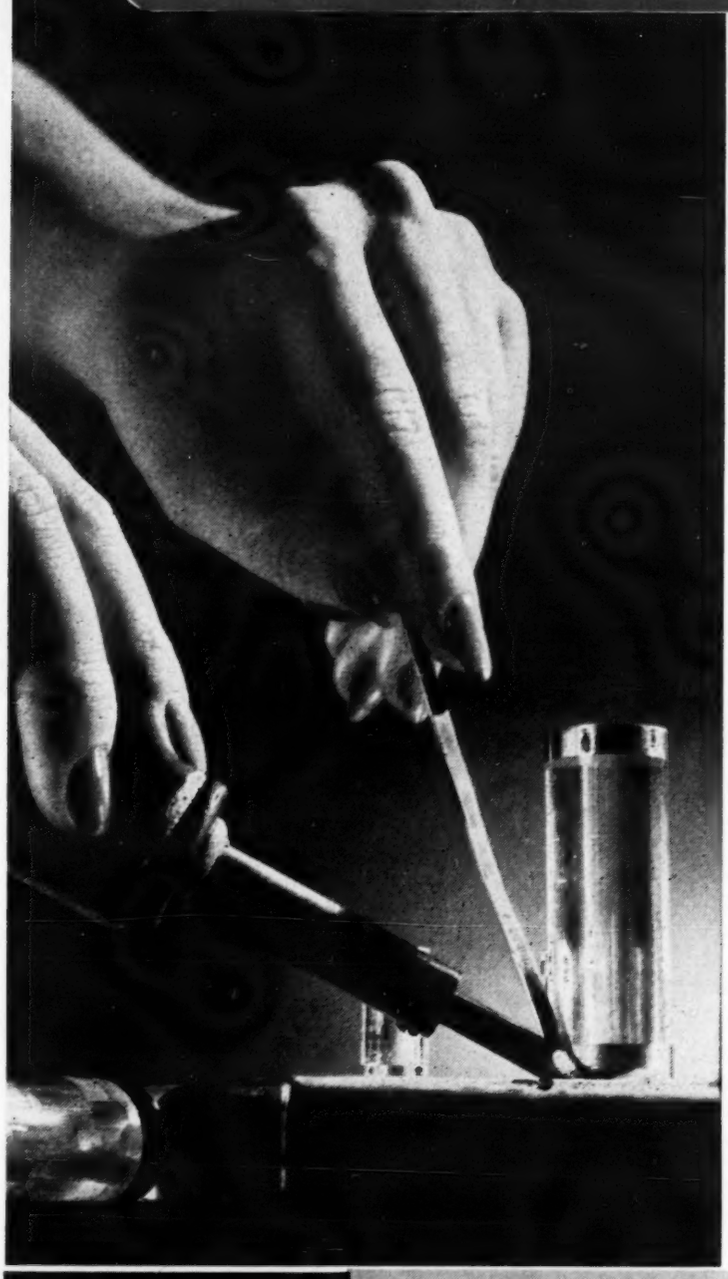
  Write today for your free copy. Address

  12 Chapel St., Newark, Delaware

Continental-Diamond FIBRE COMPANY

Established 1895 . . Manufacturers of Laminated Plastics since 1911 — NEWARK • DELAWARE

HOW TO PUT ONE AND ONE TOGETHER — AND GET ONE!



IT wasn't so long ago that soldering metal to glass was considered an impossibility. Yet today Corning Glass has developed a metallizing method whereby the base for the solder actually becomes an integral part of the glass itself, producing permanent hermetic seals. The metallized layer solders as easily as brass or copper and is not harmed by normal soldering temperatures. Parts can be soldered to it by an ordinary soldering iron, soft air-gas flame or induction heating. Truly, in this case, you can put one and one together—and get one!

Best of all, Corning type metallizing can now be applied to an extremely wide range of Corning's standard and extra-strong glasses. Where extreme resistance to thermal or mechanical shock is required it can be applied to tempered glass. Where electrical characteristics are of prime importance it can be applied to some of the special low-loss glasses such as Corning's "Pyrex" Multiform Glass No. 790.

If you have a difficult assembly problem on units which must be sealed against leakage of air, oil or water—Corning's metallizing method may very well prove an efficient, money-saving answer for you. But whatever your problem, we want you to know that Corning's unmatched "know how" in glass is always at your service. As a starter we'd like you to have a free detailed study called "There Will Be More Glass Parts In Post-war Electrical Products." Simply write the Electronic Sales Department W-3, Bulb and Tubing Division, Corning Glass Works, Corning, N. Y.

CORNING *means* Research in Glass

Electronic Glassware

T.M.REG. CORNING U.S. PAT. OFF. T.M.REG. PYREX U.S. PAT. OFF.

"PYREX" *and* "CORNING" *are registered trade-marks of Corning Glass Works*

C-D CAPACITOR SPECIALISTS

CAN SOLVE YOUR POWER PROBLEMS TODAY

If your present facilities cannot supply your power needs, if you want to improve your voltage, C-D power factor specialists can solve your problems today. Low power factor wastes existing facilities and may cause excessive power bills. C-D capacitors will boost power factor, releasing transformer and circuit capacity. They will also increase the working load capacity of the entire system.

Compact, easy to install, Cornell-Dubilier capacitors are less expensive than additional electrical distribution equipment, they require a minimum of critical man hours and materials.

Case histories prove that C-D capacitors keep paying dividends long after they have paid for themselves. We invite your inquiries. Cornell-Dubilier Electric Corporation, South Plainfield, New Jersey.

There are more Cornell-Dubilier Capacitors in use today than any other make.

MICA • PAPER • DYKANOL WET AND DRY ELECTROLYTICS

Cornell-Dubilier

capacitors FOR POWER-FACTOR IMPROVEMENT

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INCORPORATED

5,288 TYPES OF RELAYS

Each available in
countless coil combinati ns

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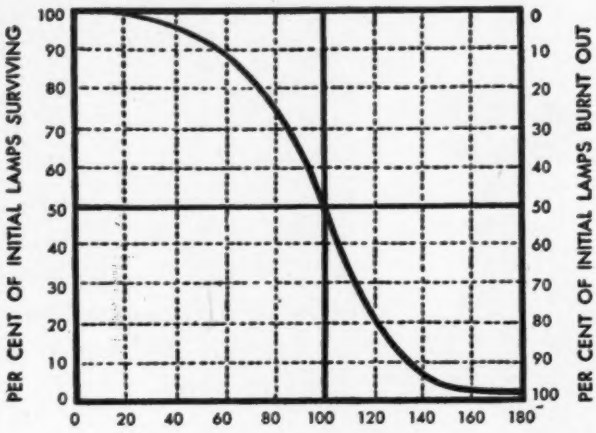
NEW YORK • PITTSBURGH • ST. LOUIS • SAN FRANCISCO • SEATTLE • SYRACUSE • TORONTO • WASHINGTON

Fluorescent operating hints

No. 2 of a series published by SYLVANIA for all users of fluorescent lighting

HOW TO GET FULL LAMP LIFE

Average rated life of good-quality fluorescent lamps is 2500 hours for the 40-watt size — 3000 hours for the 100-watt size. But the life of individual lamps may vary as the chart shows:



And actual operating conditions seldom are as favorable as controlled laboratory tests. Nevertheless, these average rated life figures will help you estimate how many lamps you will normally replace every month. Simply use 2500 or 3000 hours as indicated in this formula:

$$\text{Expected lamp renewals per month} = \frac{\text{No. of lamps} \times \text{average burning hours per month}}{\text{Rated average life of lamps in hours}}$$

If your actual monthly replacements consistently exceed the calculated figure in your own formula, it will pay you to check these five factors, which shorten lamp life:

1. TOO FREQUENT STARTING: Average rated life is based on lamps operating for not less than four hours every time they are started. More frequent starting dissipates the filament coating vital to fluorescent performance — and thus shortens lamp life.

2. DEFECTIVE STARTERS: Starters that are not working properly may cause the lamp to blink off and on, a condition that also shortens lamp life. Sylvania Starters cost only a few cents and should be replaced as necessary to protect your lamp investment.

3. VOLTAGE VARIATIONS: Fluorescent lamps are made to operate within specified *ranges* of voltage — for example, 110-125 volts. Variations within the specified voltage range do not seriously affect a lamp. But at voltages much below the range, starting becomes uncertain, and there is an excessive drain on electrode material — with a resultant toll on lamp life. Above the normal range, there is also a life-shortening effect. In addition, light output also is affected by voltages outside the normal range.

4. LOW TEMPERATURE: Fluorescent lamps are designed to operate most efficiently between 60 and 90 degrees Fahrenheit. If low temperatures are unavoidable, lamps may be protected with enclosed fixtures.

5. EXCESSIVE VIBRATION: This reduces lamp life and can often be prevented or minimized.

For Additional Maintenance Information

Send for this Free Booklet

100,000 already distributed

SYLVANIA ELECTRIC PRODUCTS INC.

"Fluorescent at its Finest"

SALEM, MASSACHUSETTS

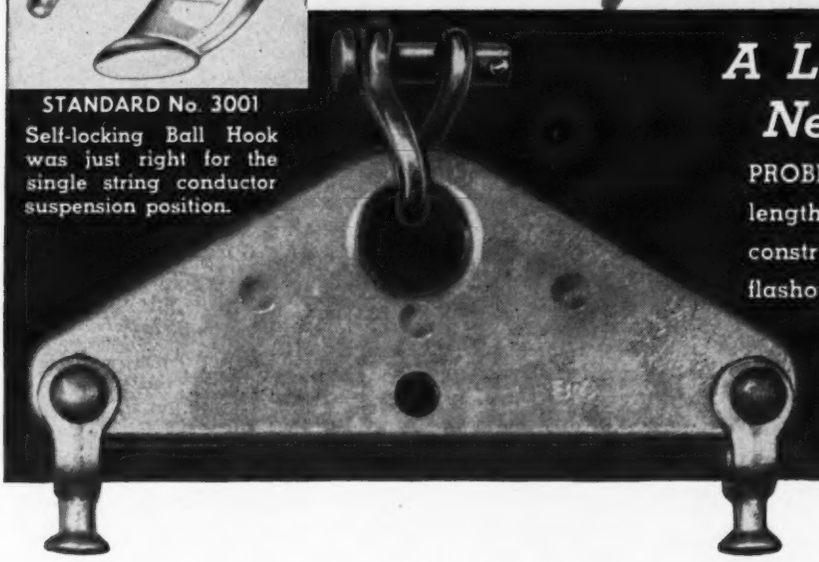
FLUORESCENT LAMPS, FIXTURES AND ACCESSORIES, INCANDESCENT LAMPS, RADIO TUBES, CATHODE RAY TUBES, ELECTRONIC DEVICES

STANDARD No. 3001
Self-locking Ball Hook was just right for the single string conductor suspension position.

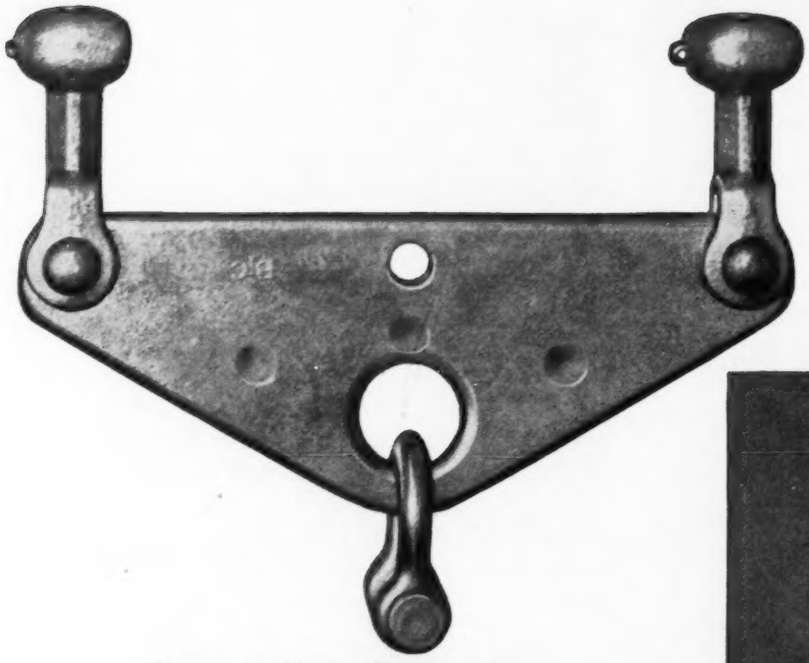
ANOTHER *Transmission*

A Large South American Tr... Needed Fittings to Meet Sp...

PROBLEM. Limited tower-to-conductor string length, unusually short in the case of two string construction, without reducing normal insulator flashover value or sacrificing desirable flexibility. Ease of assembly to tower and to clamp for Hollow Copper Conductor. Adequate strength. Use of available standard parts.

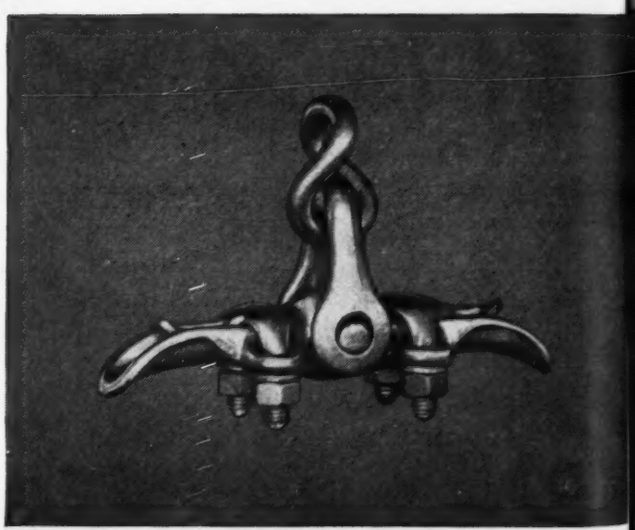


SOLUTION. Two String Conductor Suspension Assembly. Note use of standard twisted and straight shackles at top and bottom assembled through large holes in standard drop-forged yoke plate to obtain short coupling length without sacrificing flexibility thus making possible the use of the lower plate of socket clevises of sufficient length to maintain the normal insulator flash-over value.



Ground Wire Suspension

Standard No. 8200 Trunnion Type Ground Wire Clamp with No. 3080T. Twisted Link provided an assembly with adequate length of cable supporting area and with all-direction flexibility.



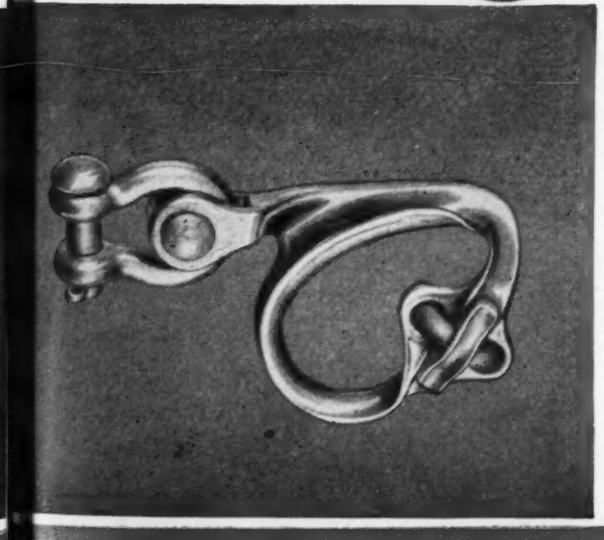
HI-TENSION SUSPENSION

THE BREWER-TITCHENER CORPORATION

Problem Solved . . .

Transmission Project Specific Requirements

This two-string conductor Dead End Assembly consists of standard BTC die-forged yoke plates for full radius round edges and corners, superior strength, finish and corona performance—proper fittings to maintain the normal insulator flash-over—terminal fittings to satisfactorily assemble to tower plate and to Cable Manufacturer's Strain Clamp.



Ground Wire Strain Clamp

The No. 2104 Clamp, close-coupled, light in weight, and with low moment of inertia combined with No. 3022 Shackle Clevis for flexible attachment to tower plate, proved an ideal method of dead-ending Ground Wire.

Through Your Insulator Manufacturer Only

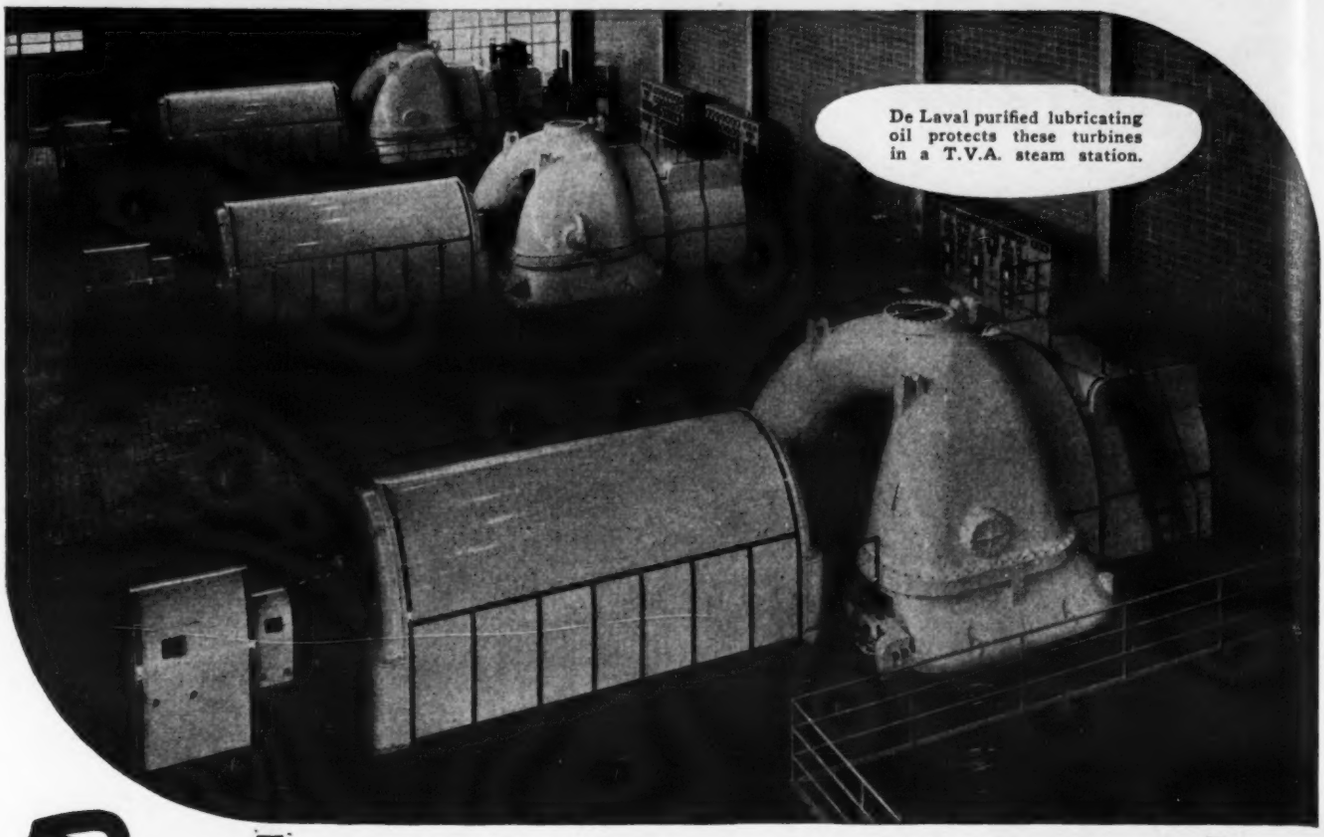
ARMY-E-NAVY

AWARDED TO
CORTLAND FORGING DIVISION

BTC

LINE HARDWARE

CORTLAND, NEW YORK



DE LAVAL PROTECTION
Helps Keep Turbines on the Line

TO the 96% of America's largest utilities that use De Laval Oil Purifiers may be added many government power projects. And whether the power plant is government-owned, a private plant or a central station, the protection afforded by De Laval Oil Purifiers against the troubles caused by dirty lubricating oil is a positive factor in making uninterrupted operation possible. Most of the larger turbines in the country already have De Laval protection—so do hundreds of smaller turbines and other prime movers.

By continuously by-passing a portion of the oil through a De Laval Centrifugal Oil Purifier, water and dirt are removed and the formation of sludge is retarded. Danger of bearing failure and of trouble with other lubricated parts is practically eliminated when the oil is thus purified.

Either by themselves or as part of the De Laval-Funk Process, these machines keep lubricating oil in a condition most nearly identical with that of new oil.

It will pay you to investigate.

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THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York, 6 — 427 Randolph St., Chicago, 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco, 19
THE DE LAVAL COMPANY, Limited
MONTREAL — PETERBOROUGH — WINNIPEG — VANCOUVER

DE LAVAL OIL PURIFIERS

PUT YOUR INCREASED *Spring* LOADS UP TO FWD's

Line materials and equipment are taking a hard-beating in war service on the home front. With Spring will come an increased surge of emergency and routine maintenance work. Trouble-shooting crews will be shorthanded. They will need the speed and stamina of FWD's more than ever before.

FWD's are "old-timers" in public utility service and maintenance work. From coast to coast . . . from Mexico to Alaska . . . they are the "preferred stock" in trucks. More than 150 Public Utilities operate fleets . . . of more than 200 in many cases . . . all year 'round.

Treat your FWD's right and they'll serve you reliably. Call the nearest FWD factory branch, district service man, or dealer regularly for sound maintenance advice and skilled service.

THE FOUR WHEEL DRIVE AUTO COMPANY, Clintonville, Wisconsin

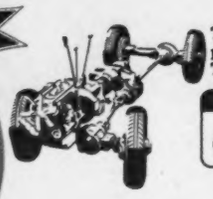
***Canadian Factory:* KITCHENER, ONT.**

★ **FOUR WHEEL DRIVE *Hauling Power* HELPS RELIEVE SHORTAGE OF *Manpower***

You can make the most of available manpower with FWD's in maintaining vital communication and power lines...both of which are needed still more in 1944 to clinch Victory. Keep FWD's on the job!

ARMY NAVY

FWD TRUCKS



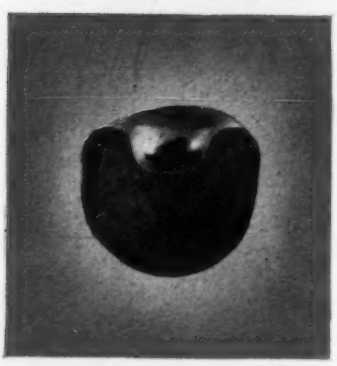
The True Four-Wheel-Drive Principle With Center Differential Saves: Tires • Gas • Oil • Replacements

THE OLDEST AND ORIGINAL EXCLUSIVE . . . *BUILDERS OF FOUR-WHEEL-DRIVE TRUCKS*

IN EVERY FIELD WHERE TRUCK QUALITY IS PUT TO THE TEST . . . FWD's STAND UP

COMMERCIAL CONSTRUCTION UTILITIES OIL FIELDS MILITARY

The Tool you'll soon *connect with!*



The torch bows out. Today, small wires are terminated or linked together simply by *Indenting* the connector to the wire with the Burndy HYTOOL. Speedy and simple . . . *for no torch, no fuel, no acid are necessary.*

But the *big* feature is that simple Indenting *eliminates faulty connections.* Note the cross-sectional view at the left . . . showing how connector and conductor have been *permanently joined* by indenting with the HYTOOL. *The connection is on to stay!*

It's a better electrical conductor, too; since the Burndy HYDENT connectors used are of one-piece, pure copper construction. *No seams or joints to loosen, or increase resistance!*

Why not have the complete story on this modern connecting method at your fingertips. The Burndy HYDENT Catalog, available on request, gives complete details.

Headquarters for connectors

Burndy

BURNDY ENGINEERING CO., INC.
107 EASTERN BOULEVARD, NEW YORK 54, N. Y.
IN CANADA: Canadian Line Materials, Limited, 13

60-cell Exide-Chloride Battery at the Holly Oak Substation of the Delaware Power and Light Co. The Exide Charge Control is shown mounted on the wall, with the fan-cooled, copper-oxide rectifier on the floor below it.

The Substation is Williamsburg Colonial in Design and fully automatic in operation. Ultimate capacity 4,800 k.v.a.

Here is efficiency *PLUS*... and it depends on Exides

The Holly Oak Substation of the Delaware Power & Light Company is located approximately five miles north of Wilmington, Delaware, and was built to provide for the rapid growth of residential and industrial loads within a four-mile radius.

BUY TO LAST
SAVE TO WIN

The two incoming 11,800-volt supply lines are so interlocked by means of a ring bus that when trouble develops on one line the load is automatically transferred to the other line without interruption of service. When the trouble is corrected the faulted line is automatically returned to service.

Outgoing 4,160-volt feeders, one for each transformer, are protected by the 11,800-V. ring bus breakers so connected that, in case of line trouble, they will close three times and then lock out, if the trouble has not been eliminated.

An Exide Battery, Metering and Relaying Equipment is housed in an attractive Colonial type brick structure. The 60-cell Exide-Chloride Battery used to operate the circuit breakers is kept fully charged... regardless of the demands made upon it... by means of a fan-cooled, copper-oxide rectifier, interconnected with an Exide Charge Control. Every hour, a small charge is automatically given the battery... just sufficient to keep it in a fully-charged condition without gassing.

Numerous other efficiently-engineered plants throughout the country rely on Exide-Chloride Batteries for a variety of stationary charges. Exide Batteries have earned a reputation for dependability, long-life, and easy maintenance over a long period of years. When you buy an Exide, you *Buy to Last*. Take care of your Exide, and *Save to Win*.

ARMY E NAVY

Exide
CHLORIDE
BATTERIES

THE ELECTRIC STORAGE BATTERY CO., Philadelphia 32

Exide Batteries of Canada, Limited, Toronto

LINE OPERATORS DIDN'T NEED A WAR TO TEACH THEM THIS LESSON—

Don't be shortsighted about conductor size

ALUMINUM CABLE STEEL REINFORCED

A.C.S.R. size, A.W.G.	Copper equivalent, A.W.G.	Diameter, inches	Resistance, ohms per mile (61% at 25°C.)	Ultimate strength, pounds	Weight Pounds per 1000 feet
1/0	2	0.398	0.885	4280	145.6
2	4	0.325	1.41	3525	107.2
4	6	0.257	2.24	2288	67.4
6	8	0.198	3.56	1170	36.2

Even before the war, experienced operators had realized the wisdom of building lines with adequate conductors. Some were obliged to install voltage boosters to take care of expanding demands. Others were taking down and replacing conductors which had proved too small to deliver the power.

Designers of electrical lines can profit by this lesson so many others have learned. Your lines must not place a barrier in the way of such expansion. Revenue is dependent upon their ability to deliver power when and where it is needed.

Your promotion department is doubtless all set to teach farmers and homemakers how to make their work lighter by using more electricity. Manufacturers of electrical appliances will certainly do likewise, just as soon as they can resume production. Plan on plenty of conductivity to take care of these growing loads.

Alcoa engineers will gladly assist you in the selection of the proper size of A.C.S.R. Write to ALUMINUM COMPANY OF AMERICA, 2138 Gulf Building, Pittsburgh, Pennsylvania.

ARMOR RODS...
AN ALCOA CONTRIBUTION TO GREATER RELIABILITY

REINFORCEMENT AT SUPPORTS

ALCOA ALCOA A·C·S·R

8 STEPS *to help you* put your lighting department ahead for postwar

1. **Find out what your customers need in lighting.** Make a field check and get the facts. (Some have already done this—and been surprised.)

2. **Plan the training of your lighting men.** With more variety in filament and fluorescent light sources, it will take more knowledge to apply them most effectively for your customers. And you'll have new men, too.

3. **Set up your sales plan for fast action.** Work out the details so you can put your program to work quickly. Being ready to start is important.

4. **Meet with all branches of the electrical industry** so that they may know your plans and all can agree on sound selling approaches.

5. **Work out your advertising and publicity program.** Decide the details of where, who and how fast.

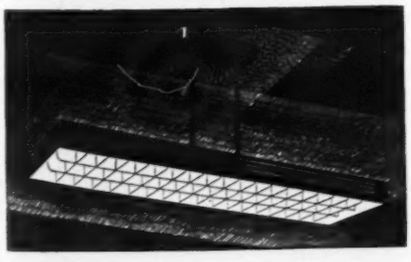
6. **Map out the stock necessary in fixtures, lamps and related items.** By establishing your requirements you can help reduce delays.

7. **Join in the Victory "light up" plans of civic groups.**

8. **Begin to build the financial reserve** needed to make your plans work. And be sure your budget is right to handle the job to be done.

Sincerely,

A. F. Wakefield



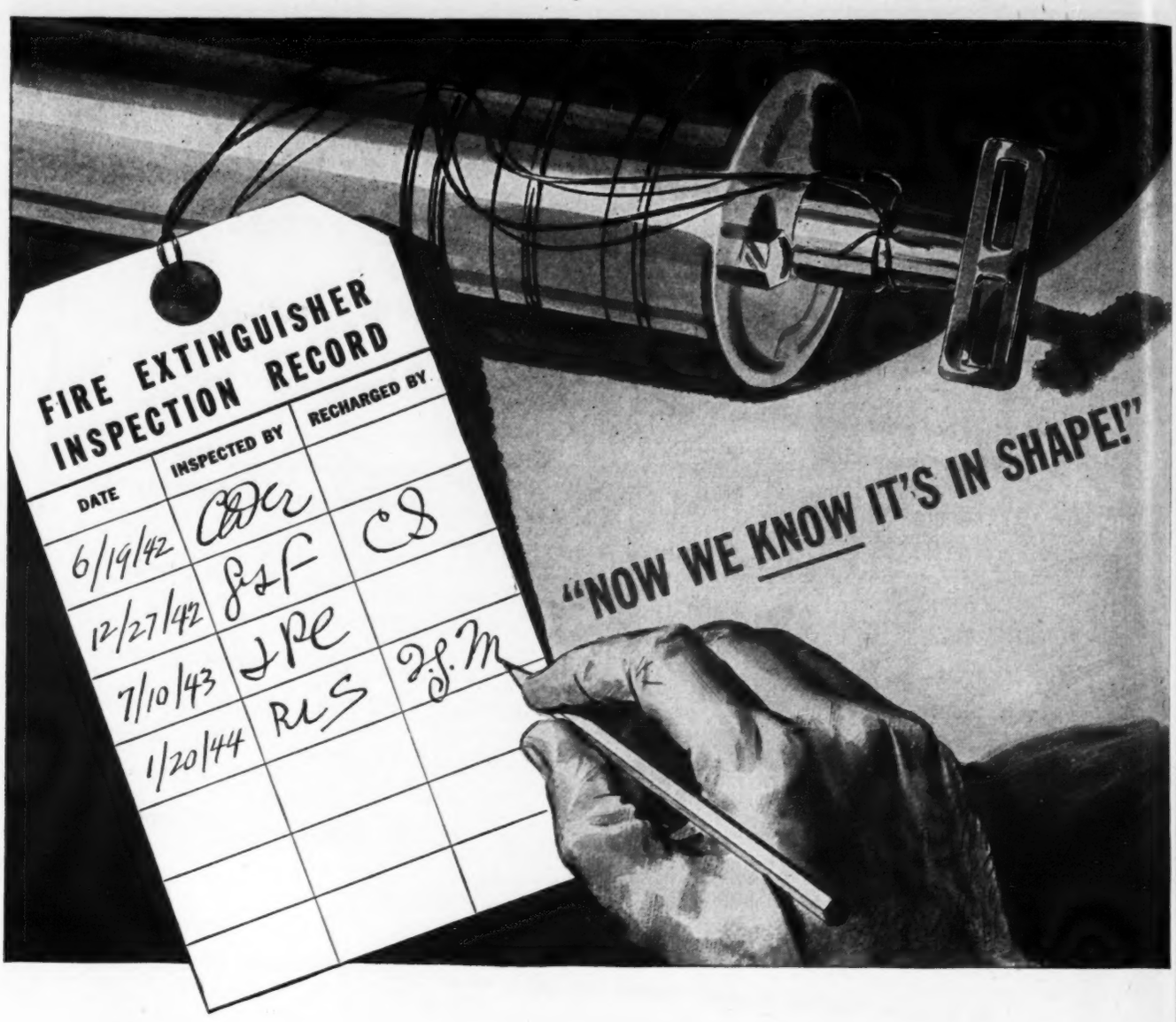
Let Wakefield help you in your planned lighting program

Wakefield lighting equipment is always engineered for top-notch performance. That's why Wakefield's policy *now and postwar* is to work with you for engineered lighting installations. Typical of the Wakefield fixtures that can help you provide good lighting for essential jobs now is the ADMIRAL. Made largely of wood, it conserves materials and provides efficient, diffused high-intensity light. Write for details.

THE F. W. **Wakefield** BRASS COMPANY

RED ● SPOT LIGHTING FOR WAR PRODUCTION . . . FOR PEACETIME FUTURE

VERMILION, OHIO



Make sure your extinguishers are ready for action

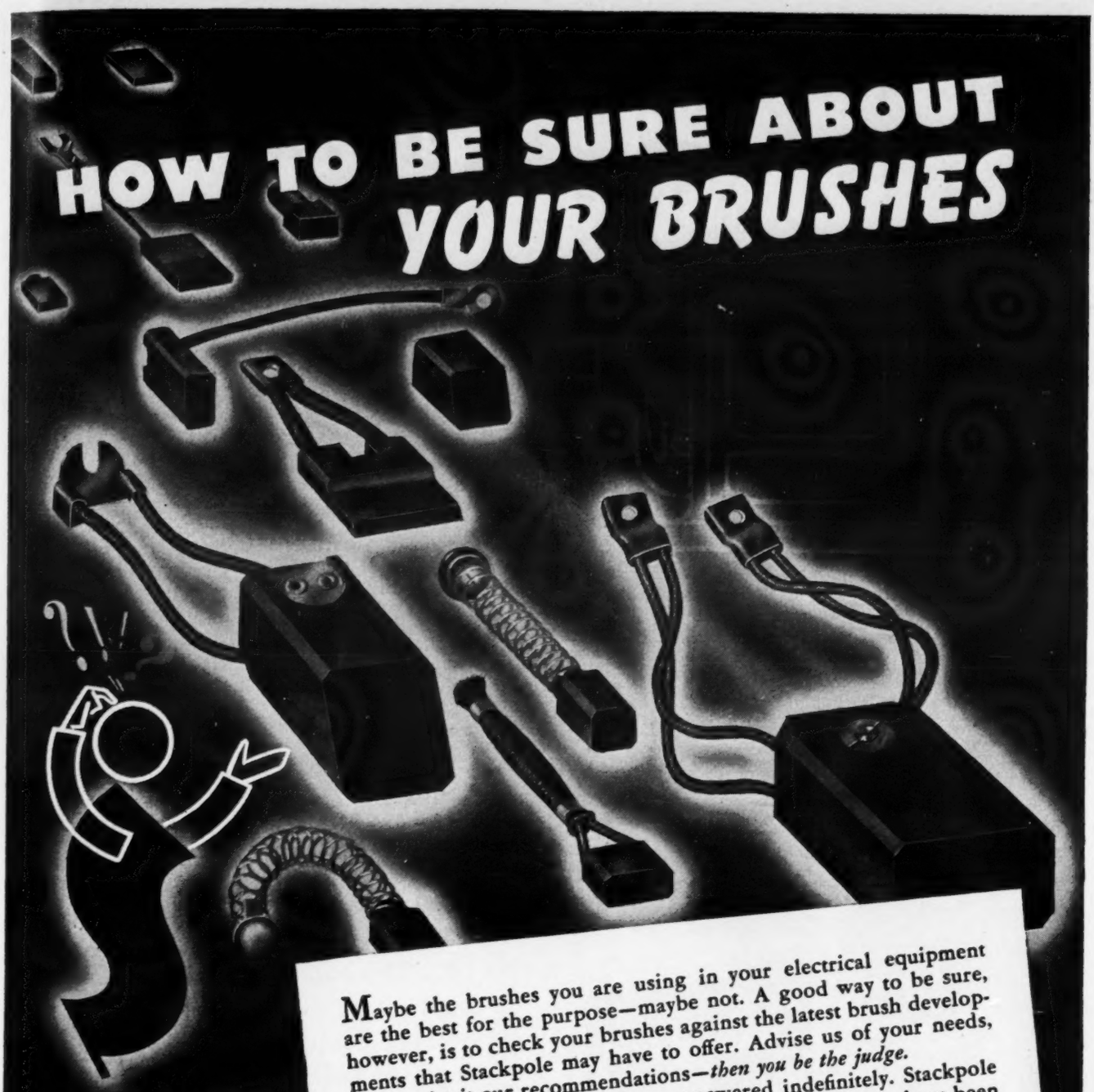
. . . free book tells how

Your fire-fighting equipment may stand unused for years—we hope it does! But when it *is* needed against real fires, it must operate instantly at top efficiency. Thorough examination at regular intervals is the only way to make sure that your fire-fighters are *always* ready to protect your plant.

To help you organize your own extinguisher maintenance system, Walter Kidde & Company has issued a booklet. It describes in simple, non-technical language the various types of extinguishers, tells which kind you need and how many of them, how often to inspect and recharge them. It shows how to mark equipment and fire stations, suggests record forms. Write for your free copy of this book. Ask for "Inspection and Maintenance of First Aid Fire Extinguishers."

WALTER KIDDE & COMPANY, INC., 325 MAIN STREET, BELLEVILLE, N. J.

HOW TO BE SURE ABOUT YOUR BRUSHES



Maybe the brushes you are using in your electrical equipment are the best for the purpose—maybe not. A good way to be sure, however, is to check your brushes against the latest brush developments that Stackpole may have to offer. Advise us of your needs, let us submit our recommendations—*then you be the judge.*

For brush problems don't stay answered indefinitely. Stackpole brush engineering moves too fast for this. Units that may have been "best" yesterday, may be outmoded in the light of today's developments. It costs you nothing to check on this score—and the Stackpole recommendations may spell new efficiency for your product.

Stackpole Brushes are sold only to makers of original equipment—not direct for replacement purposes.

STACKPOLE CARBON COMPANY, ST. MARYS, PA.

BRUSHES and CONTACTS
(*All carbon, graphite, metal, and composition types*)
RARE METAL CONTACTS
BEARINGS
WELDING CARBON PRODUCTS
BRAZING BLOCKS—CARBON PIPE
PACKING, PISTON, and SEAL RINGS
CARBON REGULATOR DISCS
STACKPOLE ELECTRONIC COMPONENTS
Iron Cores—Switches
Fixed and Variable Resistors

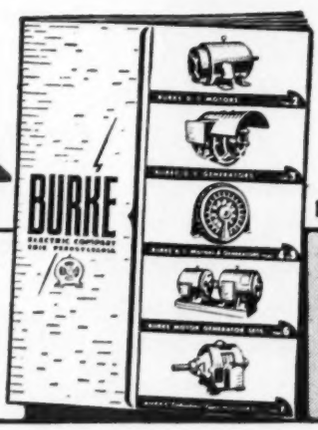
STACKPOLE

PIONEERS OF BRUSH PROGRESS

What can BURKE do for Me?

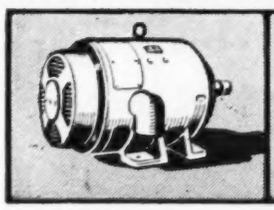
HERE'S a quick look at Burke Products to answer the headline question. When you examine each booklet, more specific questions will develop, questions that Burke engineers will be glad to answer.

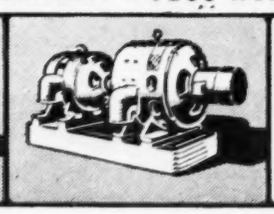
You may be surprised to learn that Burke pioneered and perfected the Universal Motor and the 3-Wire D. C. Generator, that Burke introduced the high cycle Motor Generator Set for powering High-speed Tools, and that Burke was first to use electric welding construction. In order to have you know Burke better we will be glad to send you a complete set of these Burke Bulletins.



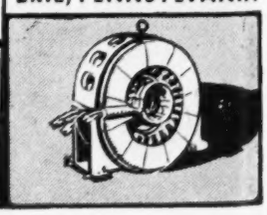
For quick reference to the Burke line, see Sweet's Catalog File and Electrical Buyers' Reference Catalog.

BURKE ELECTRIC COMPANY • 1203 WEST 12TH STREET ERIE, PENNSYLVANIA





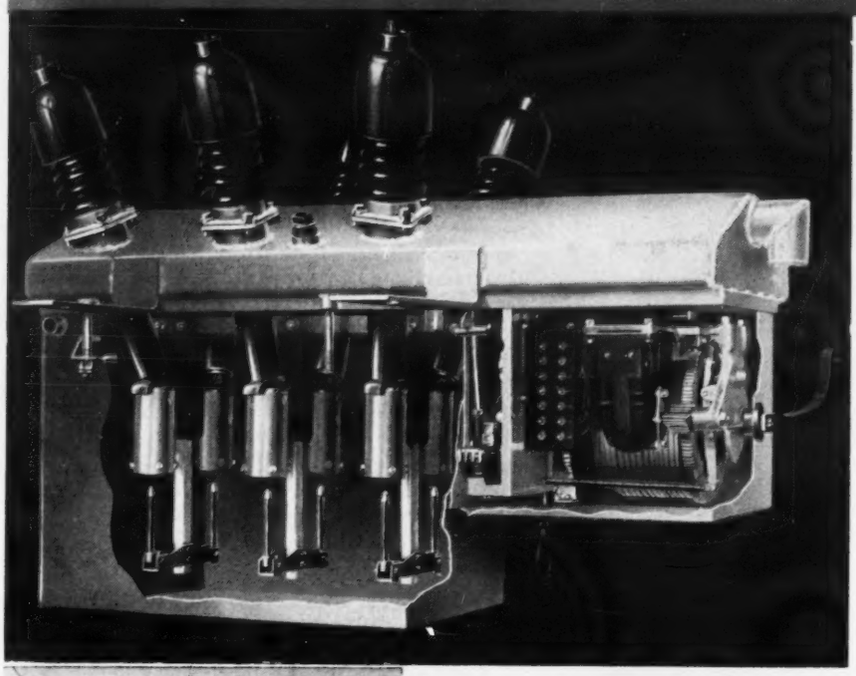
D.C. Equipment to 1500 H.P. and 1000 K.W.
A.C. Equipment to 1500 H.P and 1000 K.W.
M-G Sets to 1000 K.W.
Molded Bakelite Terminal Blocks



END OUTAGES

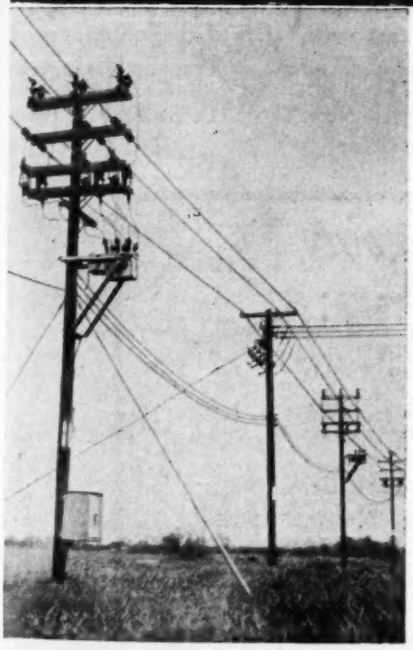
Caused by Transient Faults

ON RURAL or LOW-REVENUE LINES



PACIFIC ELECTRIC'S *Motor-Rewound* AUTOMATIC SERVICE RESTORER *Clears Faults Immediately*

Type AP-40, 100 Amperes Continuous, 1800 Amperes Interrupting Rating, 15-kv.



On Sustained Faults, Positive Spring-Stored Energy Offers 3 Reclosures Before Lockout

When a fuse "lets go" there's usually a long outage, stoppage of war production and loss of revenue.

Most of such faults are transient. Any number of them can be cleared immediately with Pacific Electric's Automatic Service Restorer which is operated by an automatically-prewound spring.

After the first reclosure, its 115-volt motor starts rewinding the spring, taking 60 seconds rewinding time for the energy expended in each reclosure operation. If faults are 60 seconds apart, the spring is always fully wound—giving you 3-reclosure protection at all times before lockout which occurs on sustained faults.

You get a choice of reclosing intervals, also easy outside adjustments of current and inverse-time-delay tripping. Emergency manual operation is provided.

You get fast arc extinguishment with the Expulsion Contacts which save oil deterioration. You have greater safety and a saving of line patrolling. Special accessories available for special applications.

Made by the Pacific Electric Mfg. Corporation, for 38 years specialists in line-protection equipment, the low-cost Motor-Wound Automatic Service Restorer reduces outages to momentary duration at scores of installations. Find out more about clearing any number of transient faults immediately on rural or low-revenue distribution lines.

C. H. Cutter
1015 Securities Bldg.
Seattle, 1, Wash.

G. B. Kirkwood
437 S. Hill St.
Los Angeles, 13, Cal.

J. E. Redmond Co.
448 W. Madison St.
Phoenix, Ariz.

C. C. Musgrove
508 Insurance Bldg.
Dallas, Texas

Other Representatives in Principal Cities

Pacific Electric Mfg. Corporation

5815 THIRD ST., SAN FRANCISCO, 24, CALIF. DUNES HIGHWAY, GARY, INDIANA

TRY TRANSITE

IF YOU'RE LOOKING FOR
THAT "SOMETHING EXTRA" IN

DUCTS

Check these features which are responsible for the reliable cableway service which Transite Ducts provide:

Inorganic . . . made of an asbestos and cement composition which provides permanence and strength, makes the ducts immune to rust or rot.

Permanently smooth bore . . . long cable pulls and replacements are made easier. Danger of damage to cables is minimized.

Easily and quickly installed . . . long, light-weight lengths and simple assembly method assure rapid, economical installation.

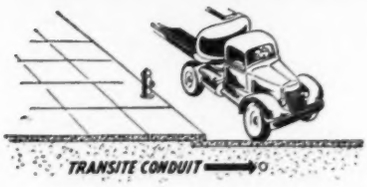
Immune to electrolysis . . . being entirely inorganic and non-metallic, these ducts are not affected by electrolytic or galvanic action.

Lower cable temperatures . . . because of a relatively high rate of heat dissipation.

Incombustible . . . won't contribute to the formation of dangerous smoke, gases, or fumes. If burnouts do occur these inorganic ducts provide maximum protection to adjacent cables and permit easy removal of damaged conductor.

For complete details on Transite Ducts, write for Data Book, DS-410, Johns-Manville, 22 E. 40th Street, New York 16, N. Y.

TRANSITE *CONDUIT*



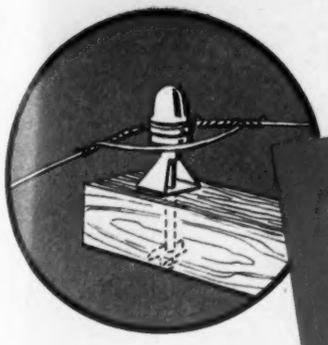
For exposed work and use underground without a concrete encasement.

TRANSITE *KORDUCT*

For installation in concrete. Thinner walled but otherwise identical with Transite Conduit.

JOHNS-MANVILLE *TRANSITE DUCTS*

JOHNS-MANVILLE
JM
PRODUCTS



FOR UNBALANCED STRESSES . . .

OLIVER

ALL-PURPOSE REINFORCED INSULATOR PIN

(PATENTED)

A relatively new item in the complete line of Oliver Pole Line Materials is the low voltage All-Purpose Reinforced Insulator Pin. The heavy steel (9 gauge) saddle welded to the pin provides the strength needed to withstand strains encountered in long spans, and in angle and corner installations. Specially suited for use with modern high-strength conductors. Desirable also for tangents to prevent bent pins on up and down grades.

With the new Oliver All-Purpose pin, more uniform strength of overall construction is obtained. Costs are kept low and your stocking problem is simplified as it is not necessary to use special pins for corner construction.

Dimensions: 5 in. from bottom of saddle to top of pin; 5½ in. from bottom of saddle to bottom of shank; width of saddle, 2¾ in.

Steel saddle firmly welded to pin absorbs excessive transverse and longitudinal loads.
1" lead thread for insulator.
⅝" dia. shank, hot dip galvanized.
Saddle base curved to fit roofed cross-arms.
Threaded to accommodate various arm depths.
Lock washer assures firm hold on cross-arms.

The new Oliver Catalog contains 190 pages of data and information on modern line materials. Send for your copy today.

POLE LINE MATERIALS

OLIVER
IRON AND STEEL
Corporation

SOUTH TENTH AND MURIEL STREETS . . . PITTSBURGH 3, PENNA.

MAKING AIRPLANE GENERATORS THRIVE

...on Tornadoes!

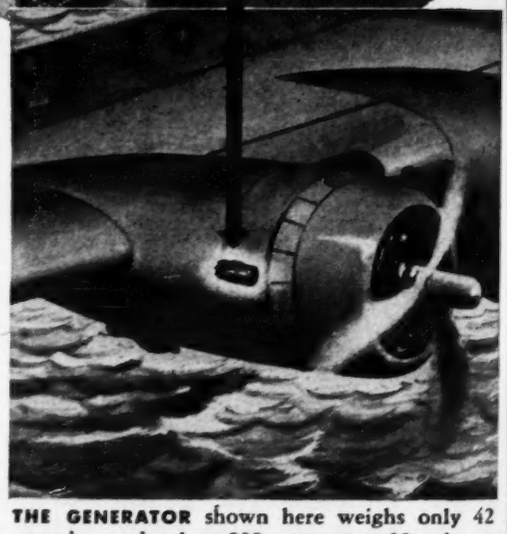
One reason why National Carbon research develops brushes that meet severest operating conditions:

THE BRUSHES that can take the punishment . . . at the highest altitudes of modern aerial warfare . . . passed their *low-altitude* tests on the stand shown above. This stand forces a veritable tornado of *accurately metered* air through a heavy-bomber generator working at rated capacity, measuring brush and generator operation under perfectly reproduced sea-level flight conditions.

The perfection of new high-altitude brushes again proves the ability of National Carbon Company's Research Laboratories staff to develop brushes of all types and for all duties . . . from locomotive motors and giant turbo-electric generators, to small, fractional horsepower units.

Research, experience, and cooperation in solving customers' problems have given "National" brushes undisputed leadership . . . have made them available in the proper grade for every application.

We invite you to bring your brush problems to us. If you have not received copies of "Modern Pyramids"—on brush principles and care—write National Carbon Company, Inc., Cleveland 1, Ohio, Dept. 16C.



THE GENERATOR shown here weighs only 42 pounds, yet develops 200 amperes at 30 volts . . . rating contingent on air-blast cooling.

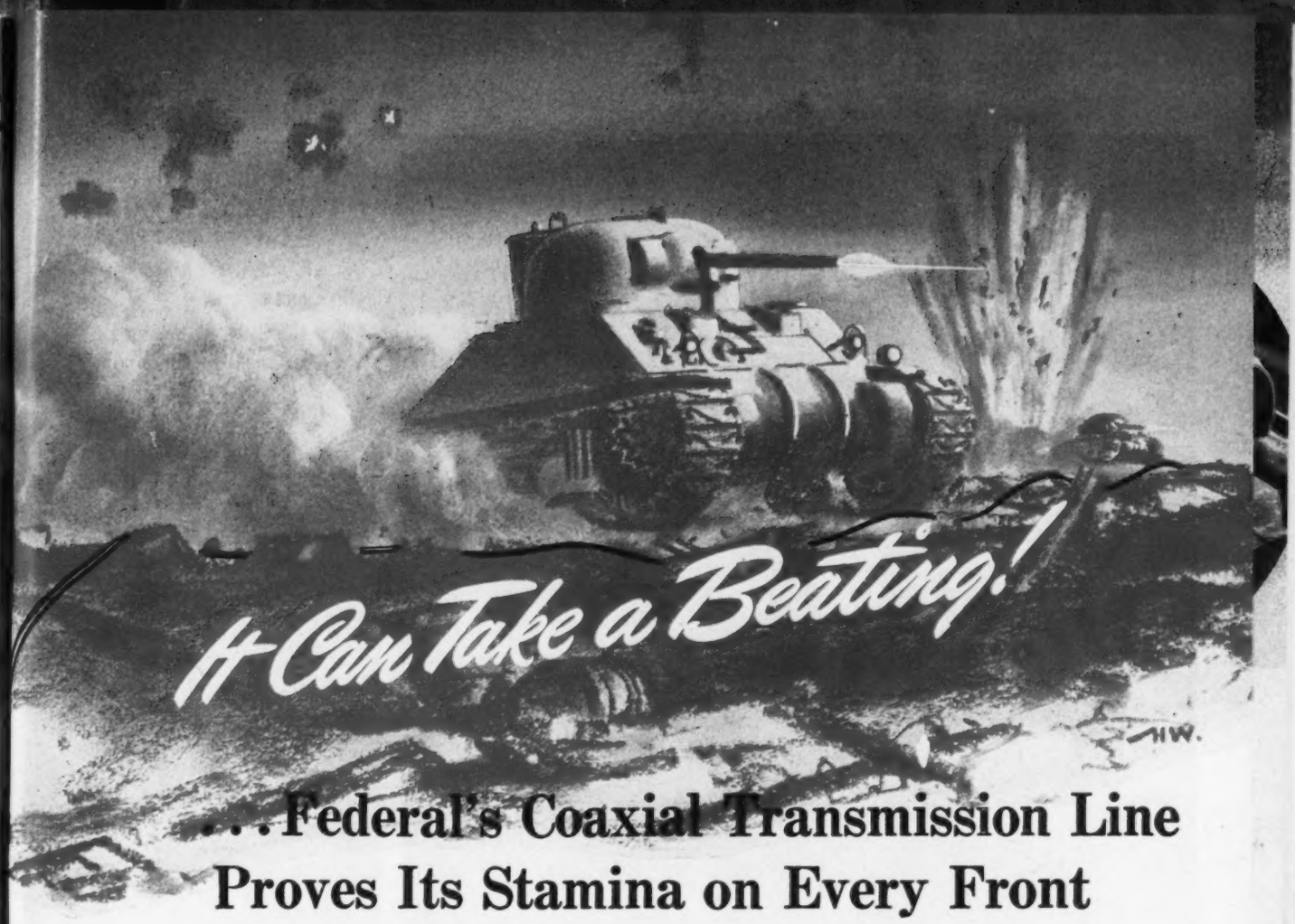
★ *BUY UNITED STATES WAR BONDS* ★

The word "National" is a registered trade-mark of National Carbon Company, Inc.

NATIONAL CARBON COMPANY, INC.

Unit of Union Carbide and Carbon Corporation

CARBON PRODUCTS DIVISION, CLEVELAND 1, OHIO UCC New York, Pittsburgh, Chicago, San Francisco

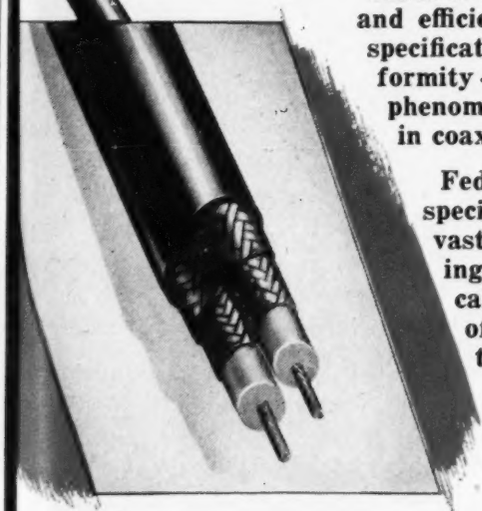


It Can Take a Beating!

. . . Federal's Coaxial Transmission Line Proves Its Stamina on Every Front

In any area of combat and wherever the performance requirements are most severe, there Federal's Ultra High Frequency Coaxial Cable measures up to every test for extreme ruggedness, strength and endurance.

Made of solid dielectric, flexible, moisture-proof and efficient in any temperature — meeting all specifications with precision accuracy and uniformity — Federal's Transmission Line embodies phenomenal characteristics never before achieved in coaxial cable manufacture.



Federal is outstanding in the field because it specializes in High Frequency Coaxial Cable, with vast experience and knowledge behind its pioneering developments. It is the largest high frequency cable manufacturer, producing in volume a range of sizes from the smallest for delicate and sensitive instruments to power cable for heavy service.

Federal's engineering skill is ready to solve any high frequency cable problem. Its productive capacity, keyed to all special demands, will make and deliver any required size, low loss, quality, Solid Dielectric Ultra High Frequency Coaxial Transmission Line.

Radio Ranges and Instrument Landing Systems manufactured by Federal mark the principal air routes of the Nation and control the landing at many leading airports. Pioneers in the development of Aerial Navigation Equipment, Federal has made spectacular contributions to aviation progress.

Federal Telephone and Radio Corporation

INTELIN DIVISION — An IT&T Associate — Newark, N. J.

Refrigeration-plant operator reads Micromax Temperature-Difference Recorder in plant of Atlantic Refining Co.

ANOTHER STEP-UP IN REFRIGERATION EFFICIENCY

CAN FOLLOW USE OF MICROMAX SHORT-RANGE TEMPERATURE-DIFFERENCE RECORDER

Refrigeration production is of course expected to be efficient at the Atlantic Refining Co.; its engineers and operators have for years kept their eyes on the heat-balance, and have applied dozens of ideas, machines and services which increase the efficiency of refrigeration-machine operation. The regular use, by this company, of the short-range Micromax Temperature-Difference Recorders seems, therefore, to indicate that this instrument has wide-spread value in many plants, for closer control of commercial-refrigeration operations.

The features of this Recorder which make it particularly valuable in this service are its short range (as little as 0-5 F) and its micro-responsiveness.

The equipment employs our standard Thermohm resistance-thermometer bulbs as temperature detectors. These are especially designed to make full use of the remarkably high sensitivity which may be attained with resistors. Also, these units are matched in resistance for the low temperature and for the five-degree range—conditions which require considerable skill and experience to overcome, but which are no longer problems to the Micromax equipment.

One of these specially-matched Thermohms is in the brine inlet, and the other in the outlet of the cooler. The Micromax Recorder measures the difference between them with a micro-responsiveness so great that some of its motion may be hard to see. But the effect shows in the record; the five degrees of temperature difference are spread across a chart almost ten inches wide, so that each degree has almost two inches. This extremely detailed showing of the temperature difference on which efficiency largely depends helps the refrigeration-machine operator to anticipate temperature changes—head them off while they're still only beginning—hold temperature with the steadiness essential to highly efficient refrigeration.

Close-up of Micromax Temperature-Difference Recorder. Range is only 0-5 F; note open, easy-to-read record curve. This instrument operates directly from 115-volt line; no dry cells employed; thus its sensitivity is not impaired by voltage changes.

This Micromax and all other models are described in Catalog N-33C, sent on request. If you have a specific problem in refrigeration, however, we suggest that you outline it so that additional specific facts can be submitted.

Jrl Ad N-33C-706(1)

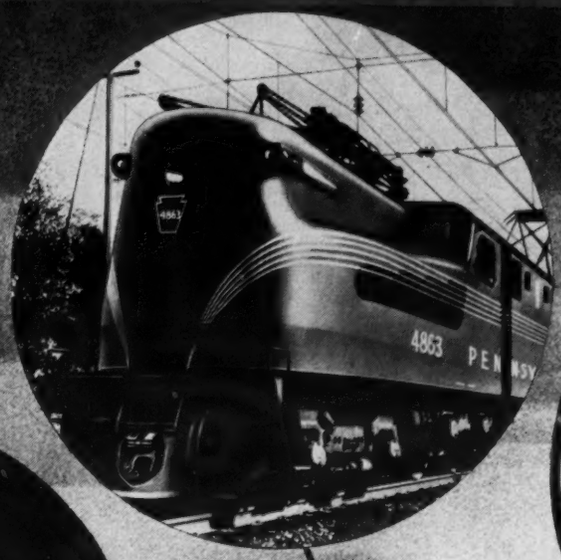
depends on me!

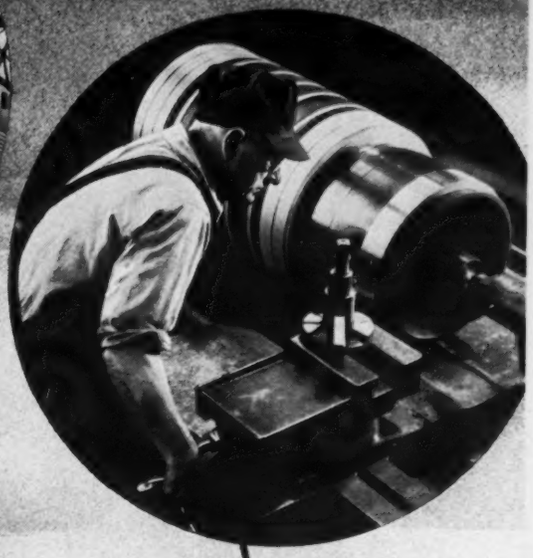
A Slogan For Every American

LEEDS & NORTHRUP COMPANY, 4938 STENTON AVE., PHILA., PA.

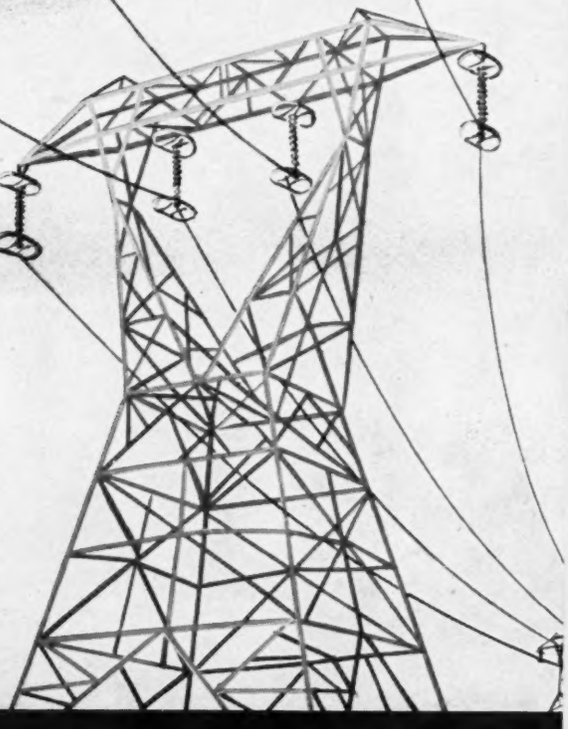
LEEDS & NORTHRUP

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES





AT THE "END OF THE LINE"



The "Hi-Pot" that rides across the country on the massive shoulders of Blaw-Knox towers finally reaches the "end of the line" for countless uses . . . tools, transportation, light and heat which have made possible our amazing war production.

They are the towers which utility engineers depend on for efficient and economical operation.

BLAW-KNOX DIVISION of Blaw-Knox Company
2013 Farmers Bank Bldg., Pittsburgh, Pa.

BLAW-KNOX TRANSMISSION TOWERS

National Electric
FLORDUCT

Kick proof... Mop proof... Strong... Safe

Florduct—To enclose wires on the floor. Takes care of the great immediate demand for office, warehouse, store and factory rewiring. Approved by Underwriters' Laboratories, Inc. Write for Catalog and Handbook.

NATIONAL ELECTRIC
PRODUCTS CORPORATION
Pittsburgh, Pa.

Post-War Freedom

A woman was heard to remark to a friend the other day that she hoped this war would never end because never before had she had so much. One's first reaction is what a horrible thing even to think, let alone say. And yet how many business heads are today a little worried about the time when the security and full employment of war shall cease and the freedom we have been fighting for begins?

How much of that worry can be laid to lack of faith in their own ability to overcome the obstacle of post-war confusion? How much can be laid to a narrowness of vision? How much can be laid to malcontents who are punch drunk from their battles with the New Deal and can see nothing ahead but continued retreat before the forces of public ownership?

Regardless of the cause business must erase that fear. The public is restless under war restraints and looking forward to the day when there is freedom—freedom to go where you like, to buy what you want, to work where you please. The public has found out that whenever the freedom of business is curtailed, freedom of people is also circumscribed. The public understands more than ever before the meaning of free enterprise.

This post-war freedom for business is not something bestowed by a government but rather a right returned and reconfirmed by the people of the country. With this return of freedom will go the responsibility to be as great in peace as we have been in war. American business has demonstrated its superb ability to produce, whether it be turbines or kilowatt-hours; it will have the opportunity to demonstrate after the war whether its business initiative is as good.

However, we shall not be able to maintain freedom of business if we lean too heavily on pre-war statistics as our guide to post-war accomplishment. Our post-war program therefore must be born in vision and just as war demanded the impossible of business so peace is setting goals that five years ago would have seemed fantastic.

In the electric utility field, for instance, the pre-war job of increasing residential usage helped the power business to surpass its pre-depression peak a full year before business generally had succeeded in equaling that same peak. During that time the annual average usage increased at the rate of approximately 50 kw.-hr. a year.

That was a fine job but it is small in comparison with the post-war job that can be done if unrestrained vision sets the goal. Take a goal of double the present usage of around one thousand kilowatt-hours average per residential customer. At the pre-war rate of annual increase it would take twenty years to reach a goal of 2,000 kw.-hr.

There is hardly any one but will admit that that is much too slow for post-war. How much can it be shortened? There are some who are laying plans to reach that goal in the first five years of free post-war markets. Those who want twice as long or longer call them dreamers lacking in realism. Maybe they are. Maybe they won't reach that goal in the allotted time but who is there to say that they won't be nearer that goal in five years than those who set their sights more realistically?

The realistic approach will probably be less expensive and safer, but the post-war stake we are fighting for is freedom, and freedom and safety were never synonymous.

Time and Frequency Standards on Interconnected Systems

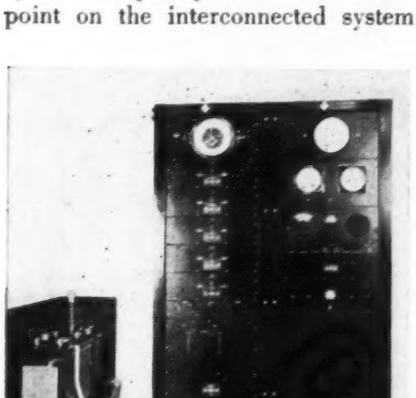
Time and frequency standards achieve new importance as growing interconnection increases difficulty of frequency-time control by one portion of system — Electronic standards help all parts of a system to work together to make connection

R. J. DONALDSON, Senior Electronics Engineer, Commonwealth Edison Company, Chicago

AS INTERCONNECTED power systems have become larger, it has become increasingly difficult for any one portion of the system to control frequency or time without overloading transmission lines tying different systems together, or at least upsetting the load schedules on these lines. The tail seems to be growing too big for one dog to wag. Such has been the case on this system.

Time and frequency standards of extreme accuracy are necessary on the different systems if they are to work together. For, while frequency can be taken care of by very accurate frequency bridges, time must be corrected by comparison with standards whose errors are kept small compared with the normal variation in system time.

When frequency departs from 60 cycles a frequency meter at a central point on the interconnected system causes throttles on turbines to open or close to make frequency corrections. If, in spite of these corrections, frequency departs appreciably from normal, remote points on the system may alter their scheduled tie-line loads to assist the central point which has assumed responsibility for frequency control. Similarly time standards installed on different systems that are interconnected cause them to work together in making corrections of time.



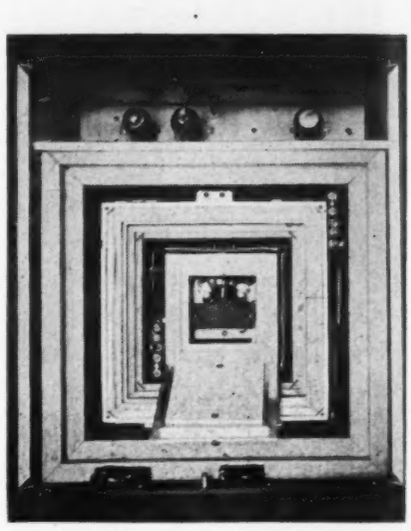
TIME AND FREQUENCY STANDARD of Chicago company

A second need for the time standard in the case of the Commonwealth Edison Company was to supply standard 60 cycles for calibrating frequency bridges used in regulating system frequency. A third use of the standard is for calibrating audio- and radio-frequency meters used in carrier current and radio communication.

Time and Frequency Standard

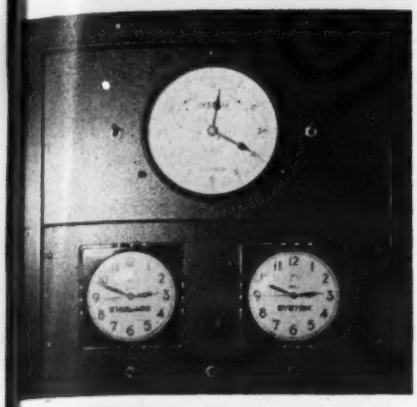
The time and frequency standard installed by the Commonwealth Edison Company is a commercial unit with some modifications and additions. Since the middle of August, 1941, the *maximum* variation of this standard from correct time has been kept to within 0.15 of one second. During this same period inaccuracy of the frequency standard has been one part in ten million or, in terms of 60 cycles, about ½ cycle per day.

The 50-kc. oscillator controls the 10-kc. multivibrator, which in turn controls the 1-kc. multivibrator. This operates a synchronous clock in which a 60-cycle current is generated. This current is amplified, transmitted over a telephone line, amplified again and fed into a time-drift indicator. This helps control the system controller, which sends out impulses to operate turbine throttles. An alternate source of 60 cycles is from the 1-kc. multivibrator to a 100-cycle multivibrator, 300 cycle filter, 60 cycle multivibrator and through a 60 cycle filter. The 50-kc. oscillator also controls a 50 kc. multivibrator whose output, along with that from the 10-kc., 1-kc. and 100-cycle multivibrators is used for audio- and radio-frequency standardization.



QUARTZ-CRYSTAL of 50-kc. oscillator in nested-"oven" is held to 60 deg. within 0.01 deg.; view looking down on open oven

Time signals are received by the radio receiver and compared with the clock. Standard 60 cycles is also fed into another amplifier which feeds a standard 60-cycle clock and a time-difference indicator. System frequency is fed into the other side of the time-difference indicator and into a system clock. With this outline established the time and frequency standard will now be discussed.



TIME DIFFERENCE INDICATOR—Dial at top is redesigned synchroscope which shows difference between standard and system time in cycles or seconds; short hand reads difference in seconds fast or slow; long hand reads cycles; reading indicated system fast 0 seconds and about 20 cycles

The power supply for the standard is from a 6-volt, 300-ampere-hour storage A battery and a 192-volt, 8-ampere-hour storage B battery; both operating on floating charge. This avoids stoppage of the time standard due to circuit outages. For floating charge voltage is kept at 2.15 volts per cell. Load on the A battery is about 9 amp.; on the B battery 115 milliamperes.

Crystal Oscillator

Heart of the standard is the quartz-crystal controlled 50-kc. oscillator. The quartz crystal, associated condensers and the inductance coil are mounted in an elaborate temperature-controlled oven mounted just above the power controls.

In the oven the crystal is mounted in the innermost of a nest of twelve boxes made of alternate heat-insulating and heat-distributing material, balsa wood, asbestos press board and aluminum. There are actually two ovens, the outer is held at about 57 deg. C. and the inner at 60 deg. C. within 0.01 deg. Sensitive mercury thermostats operate relays to turn the heater current on and off at frequent intervals.

The crystal is somewhat different from those used in radio transmitters and receivers. Radio transmitter and receiver crystals are usually thin plates whose thickness controls their frequency. Here the frequency is so low, 50 kc., that a crystal would have to be about 2 in. thick. This crystal, therefore, is made in the form of a bar of square cross-section about $\frac{1}{4}$ in. on a side and about 2 in. long. It is an x-cut. Since it vibrates lengthwise, it is clamped at the middle, where its motion is a minimum.

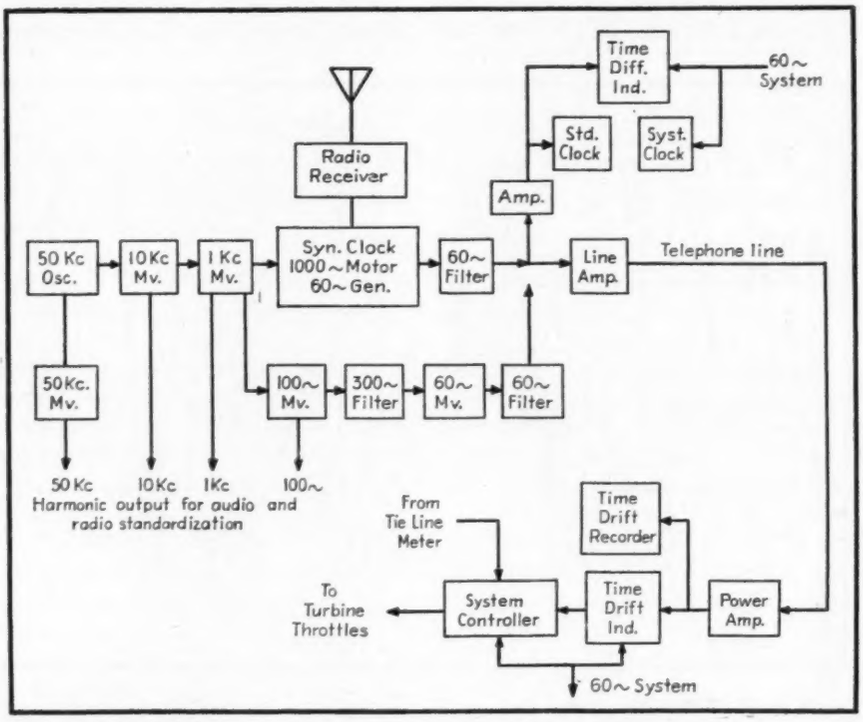
Electrodes of the crystal are plated directly on the upper and lower surfaces to eliminate air gaps. Ends of the crystal give off supersonic sound waves. Metal baffle plates are mounted $\frac{1}{4}$ wavelength from the ends of the crystal. This gives air-wave resonance, makes the bar vibrate with maximum amplitude and minimizes the effect of reflected waves on the crystal's reactance and decrement. The effect of changes in atmospheric pressure are decreased. A quarter wavelength of a sound wave in air at 50 kc. is about $\frac{1}{18}$ in. The temperature coefficient of the crystal oscillator is —1 to —2 parts per million per deg. C. Since the temperature is held within about 0.01 deg. C., the effect of temperature on frequency is negligible.

The 50-kc. crystal oscillator circuit shown looks very much like a *Colpitts* with a crystal in series with the inductance. Circuit constants, however, play only a minor part in determining the frequency of a crystal-controller oscillator—of the order of a few parts per million, yet in terms of time the control is appreciable. A change in frequency of twelve parts per million for a day produces a difference in indicated time of over a second. The crystal, inductance coil and the fixed condensers are in the oven. Fine adjustments of frequency are made by adjusting the small variable condenser which is in parallel with the larger fixed condenser in the grid circuit. The control for this is brought out the rear of the chassis. If for some reason the frequency of the crystal cannot be brought to 50 C. by this condenser, it is then necessary to add or remove turns from the inductance coil, as will be explained later.

1,000-Cycle Clock

Multivibrators, the "reducing gears" of electronics, step down the frequency of the 50-kc. oscillator to 10 kc. and then to 1 kc. Output of the 1-kc. multivibrator is amplified and used to drive the inductor type of motor of a synchronous clock at 10 r.p.s. On the same shaft with the motors is a small inductor type 60-cycle generator, which generates about 3 volts. This is the standard 60-cycle source.

Means are provided for comparing the clock with radio time signals from the Naval Observatory station at Arlington. Use is made of a shaft in the clock which rotates at one revolution per second. On this shaft is an arm which rotates inside a movable ring. In this ring is mounted a pair of contacts which shorts the loud speaker. The rotating arm opens the

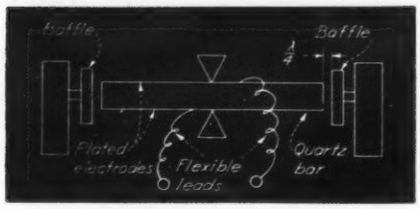


FUNCTION DIAGRAM of elements in frequency and time standard

contacts for about 5 percent of each second. On the periphery of this ring is a scale reading 0 to 100. The movable contact can be rotated to the point where the contacts short out all of each dash of the time signals received on the receiver except just the beginning, for it is the beginning which is precise. This adjustment can be made with an accuracy of about 0.01 second, which is adequate for all practical purposes. Time signals have been received in Chicago most consistently on 9.425 megacycles.

Alternate Source of 60 Cycles

While the small generator on the clock motor shaft already mentioned is the simplest way of obtaining a current of standard 60 cycles, it is dependent upon mechanically moving parts which might fail, due to wear, and might not be readily repaired. So an alternate electronic source was arranged. It was not possible to step directly down from 1,000 cycles to 60 cycles in one or more steps, because 60 is not a submultiple of 1,000, but it was possible to go to 100 in a 10 to 1 step then select the third harmonic of this, 300 cycles, and use this to control a 60-cycle multivibrator with a 5 to 1 step. The output of this multivibrator is then filtered, amplified and is ready for use. The filtering would not be required for some uses, but for checking frequency bridges it is essential. A standard of 60-cycle current is thus obtained, without the use of any mechanically moving parts, which is accurate to a few parts in 10 million.



MOUNTING for quartz crystal controlling 50-kc. oscillator which is heat of the standard

Time-Difference Indicator

The accompanying illustration shows two electric clocks, one of which is operated from the standard, the other from the system. Above the two clocks is the time-difference indicator. This gives the difference in seconds, cycles and even fractions of a cycle between system and standard frequency. The short hand and the inside scale give the seconds difference up to six seconds for half a revolution, either fast or slow; the long hand indicates cycles difference on the outside scale, which is marked 0 to 30 cycles for half a revolution, giving 60 cycles, or one second, for a complete revolution, and the smallest hand in the center requires 2 cycles for one revolution. A. L. Brownlee, water engineer, redesigned a standard synchroscope to produce this instrument. The reading at the time the photograph was taken was: System fast by 0 second and almost 20 cycles, or one-third second. It is seldom that the system time is off by more than two or thr seconds.

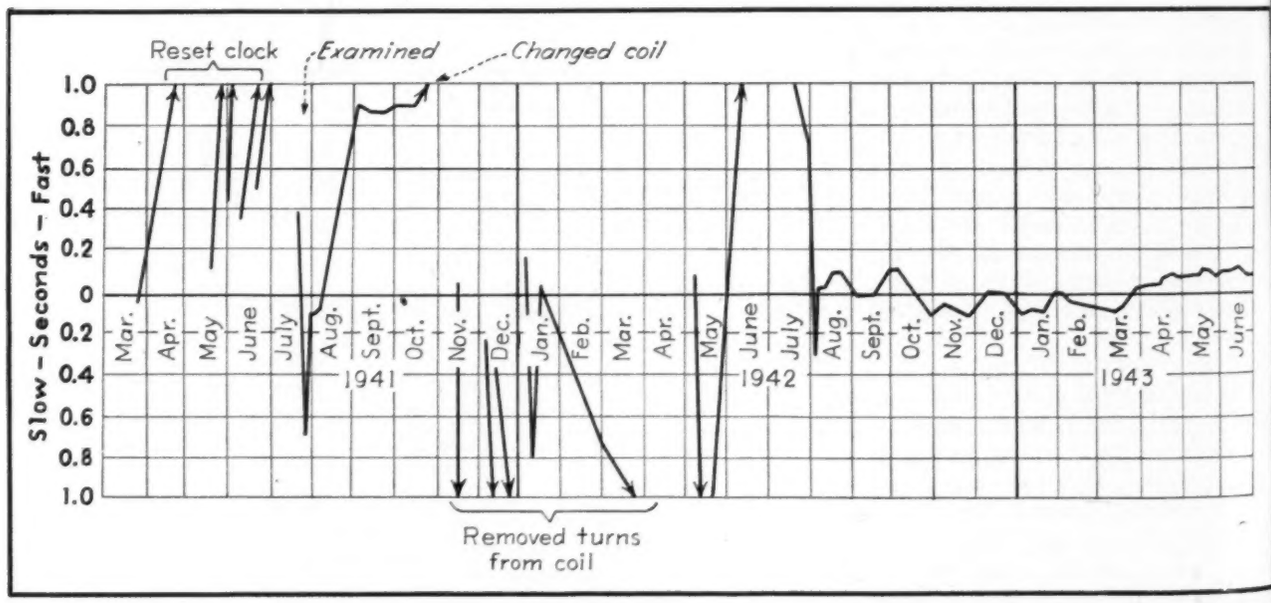
The 60-cycle standard output is f through a line amplifier, telepho line and 50-watt power amplifi (with selective feed back further smooth the wave shape) to the tim drift indicator, which helps opera the system controller.

This system controller is essential a frequency bridge whose balance no mally occurs at 60 cycles, but who balance point may be automatical shifted either way, depending upo whether the tie-line load is above o below the desired level and upo whether the system time is fast o slow. When the bridge is not in ba ance, raise or lower impulses are se to turbine governors.

In Chicago tie-line load exerts th major control. Primary time contr is exerted by systems to the east an corrections made by this system ente into the extent that it works with them never against them, in making tim and frequency corrections. Standar 60-cycle frequency is used in calibra ing the bridge of the system controlle and other frequency bridges.

Accompanying curves of time dri show the performance of the tim standard from the time it was start up near the end of March, 194 Months are plotted on the x-axis.

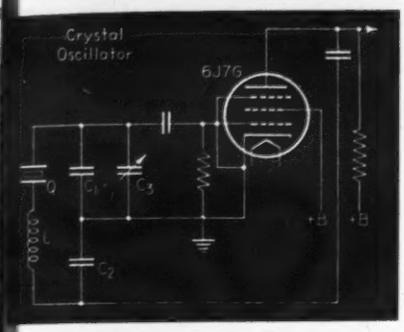
When the clock was started up i ran fast and had gained a second le fore the end of the first month. It w then set to zero time error. It co tinued to gain in spite of various a



TIME-DRIFT CURVES for standard in months since its installation: after early difficulties were overcome in August, 1941, maximum time error has held to 0.15 second

stments made on the small control ndenser. In July the oscillator was moved from the oven and everying checked. When it was started again it lost about a second the st week, then gained a second and a lf during the next month. At this oint it was almost brought under ntrol, but continued to run a little st, even with the condenser dial set n zero.

Since it was desired that the standd run correctly with the control ndenser at the midpoint of its range, mewhat more drastic measures were ken. The coil, which was in series ith the crystal, was removed from the



CRYSTAL oscillator circuit

ven and replaced with one having ore inductance. This really slowed up. One second was lost the first ay. The standard was shut down and wo hundred turns were first removed om the coil, then 100, then 70 and nally 40. This was done in several eps to avoid overshooting and havng to add turns. Removal of the 40 rns put the control in the range of e variable condenser. After this hange things went nicely. Since the iddle of last August the maximum ariation from correct time has been ept within 0.15 of one second. This as been accomplished by moving the djusting condenser dial a slight mount on an average of once every eek and a half.

Inaccuracies in standard frequenies from this unit are determined by ate of time draft. During this same eriod the maximum rate of time drift as been about 0.1 second in ten days r 0.01 second per day. Since there re 86,400 seconds in a day, this is quivalent to one part in 8,640,000. Or, roughly, the standard frequencies hould be accurate to one part in ten illion. In terms of 60 cycles, this ould be about half of a cycle per day, ince there are about five million 60ycle waves in a day.

Power Sales Promotion and Prospects

Survey shows what various advertising and promotional means are considered to be effective and indicates opinion as to post-war competition

Intensified competition in the field of industrial power sales is expected by most electric utilities when the war is over. And maybe about half of them are in favor of national advertising of purchased power as a measure against that competition. These conclusions are derived from replies to a survey on industrial power promotion by utilities and on their views as to the post-war competitive picture. The survey was made by Ford Bates, general sales consultant of the Nebraska Power Co., and the results were presented by him at a recent power sales conference of the Missouri Valley Electric Association.

Mr. Bates wrote to power sales executives of 92 electric utilities. He asked them what types of advertising had been found to be most effective, direct mail pieces, company periodicals, handouts, greetings, etc. He asked also if they anticipated there would be after the war intense isolated plant competition, principally from internal combustion engines, and if they favored national advertising of purchased power as a means to meet that competition.

The large response to Mr. Bates' inquiry, 79 replies, 86 percent of those addressed, is itself an indication of the widespread concern of power companies in regard to post-war conditions likely to affect industrial power sales. Information from 74 of the replies appears in the accompanying tabulation.

Although the point was not raised in the inquiry practically all replies stated in one way or another that first reliance in power sales is on close personal contact with customers by competent representatives. This point was emphasized, indicating that all forms of advertising and promotional pieces are regarded as supplementary to it.

The data in the tabulation may not be taken entirely at their quantitative values. This is particularly the case in regard to the entries in the last two columns, which show opinions. In regard to increased competition, 45 (61 percent) say they expect it; six (eight percent) say they do not; 23 (31 percent) express no opinion. Concerning national power sales advertising, 37 (50 percent) say they are in favor of it; seven (ten percent) say they are not; 30 (41 percent) do not reply. Not all of those who expect increased competition want to use national advertising to meet it and eight, about one fifth, of those who favor advertising apparently do not expect any great increase in competition. The large lack of coincidence between the data of the two columns shows that national advertising is not generally accepted as an effective means for meeting power sales competition. And, from qualifications attached to replies on this point, it is clear that the expressions of favor for national advertising must be regarded as opinions only, not at all as commitments of the companies named.

As for the data on forms of advertising presently used, these can be taken as more definite, although it is difficult to classify such activities. Equally in favor seem to be the uses of direct mail pieces and of a magazine promoting purchased power, 39 (52 percent) in each case. Periodicals published by the company are used in 15 cases (20 percent), while 18 (24 percent) use manufacturers' periodicals and 16 (22 percent) use handouts. There are various kinds of publicity known to be employed in power sales which are not included in the tabulation. There is, for instance, advertising in local and regional trade publications and sometimes in newspapers. Also there

is participation in, often organization of, exhibits and other presentations of local industrial activities and products. Thus it may not be concluded that companies shown by the table not to be using the forms of advertising specified are entirely inactive in power sales promotion. Also it is quite possible that for one reason or another some companies did not wish to reply to the question.

It is to be kept in mind in consideration of the data here presented that power sales activities during the period of the war are not *sales* activities in the sense of selling more power, of building up the utility's power load. Rather, they are efforts directed towards an object which has always been important to the utility—the efficient utilization of electricity by its customers to the end that they may benefit from progress in power applications.

POWER SALES ADVERTISING AND POST-WAR COMPETITION SURVEY

	FORMS OF ADVERTISING USED					POST-WAR	
Name	Magazine Promoting Pur. Power	Own Periodicals	Mfrs. Periodicals	Handouts	Direct Mail Pieces	Expect Increased Competition	Favor National Power Sales Advertising
Southern Cal. Edison	x				x	x	No
Pacific Gas & Elec.	x					x	x
Unidentified Utilities	x		x		x	x	x
Hartford Elec. Lt.	x	x				x	x
United Illuminating	x		x		x	x	
Florida Pr. & Lt.				x	x		x
Georgia Power	x	x	x	x			x
Idaho Power				x	x	x	
Commonwealth Edison	x	x			x	x	
Central Ill. Elec. & Gas							
So. Ind. Gas & Elec.						x	
Ind. Service Corp.	x				x		x
No. Ind. Public Serv.	x						x
Indianapolis Pr. & Lt.	x				x	x	x
Unidentified Utilities						x	
Unidentified Utilities						x	
Iowa-Ill. Gas & Elec.						x	x
Peoples Gas & Elec.						x	x
Sioux City Gas & Elec.							No
Kansas Power						No	
Kansas Elec. Power							
Unidentified Utilities	x					x	x
Kentucky Utilities						x	x
Louisville Gas & Elec.						No	
Louisiana Pr. & Lt.	x		x		x	x	x
New Orleans Pub. Ser.				x	x	x	
Central Maine Pr.	x		x			x	x
Potomac Edison					x	x	
Boston Edison	x				x	x	
New England Pr. Serv.							
Lynn Gas & Elec.							x
Western Mass Elec.					x	x	x
Detroit Edison	x	x	x		x		
Consumers Power	x		x	x	x	x	
Northern States Pr.	x				x	x	x
Kansas City Pr. & Lt.	x			x	x	x	No
Empire District Elec.							
Union Electric of Mo.							
St. Joseph Ry. Lt. Ht. & Pr.						x	x
Montana Power						No	
Nebraska Power	x	x	x	x	x	x	x
Pub. Serv. Co. New Hamp.						x	No
Pub. Serv. Elec. & Gas					x	x	x
Am. Gas & Elec. System	x		x		x	x	x
Buff. Niag. & East Pr.	x		x	x	x	x	
Consolidated Edison					x		
Carolina Pr. & Lt.		x		x	x	x	x
Unidentified Utilities		x			x	x	x
Ohio Edison	x		x			x	x
Ohio Power	x				x	x	x
Cincinnati Gas & Elec.	x				x	x	x
Unidentified Utilities		x			x	x	
Columbus & So. Ohio Elec.							
Toledo Edison	x		x	x	x		x
Oklahoma Gas & Elec.							No
Unidentified Utilities	x						x
Portland General Elec.	x				x		
Penn. Pr. & Lt.	x				x		x
Philadelphia Elec.	x	x			x	x	x
Duquesne Light	x	x	x		x	x	
Narragansett Elec.	x		x			x	x
Dallas Pr. & Lt.		x					
Texas Elec. Serv.	x					x	
Houston Ltg. & Pr.		x			x		
Utah Power & Light	x	x	x			x	x
Virginia Elec. & Pr.					x		
Washington Water Pr.					x	No	No
Northern States Pr. (Wis.)	x			x			x
Wisconsin Pr. & Lt.	x		x			x	x
Unidentified Utilities	x		x			x	x
Unidentified Utilities				x			x
New York Pr. & Lt.	x		x	x		x	No
Mississippi Pr. & Lt.	x	x		x	x	x	x
Pudget Sound Pr. & Lt.	x	x		x	x	No	

How About Yours?

Dirty safety goggles pushed asi so he can see may make sight impo sible for the thoughtless man. At D troit Edison Co. goggle cleaning ki

GOGGLE cleaning kit

like this are provided at strategic l cations to meet the dirty goggle me ace. Kits contain cleaning fluid, clea ing tissues and a container for t used tissues. They are made by Mi Safety Appliances Co.

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To Keep Varnish on Alternator Windings

By WILLIAM K. HOLMES

Chief Electrician, Municipal Plant, Freeport, I

Preservation of a.c. generator c insulation was a problem at the Fr port Municipal Plant. Trouble w experienced with insulating varni coming off the windings each time t laternators were cleaned, due to t oil fumes in the air given off by die engines.

The windings were cleaned with c bon tetrachloride and then an alcoh vehicle varnish was applied. Howev the varnish would not stay on t coils. There seemed to be enough remaining in the insulation to preve the adherence.

Another method was employe After cleaning with tetrachloride, naphtha varnish was applied, follow by a coat of alcohol varnish. Sin these applications were made, eig years ago, there has been no sign the varnish coming off the windin It is our opinion that varnishes wi other than naphtha vehicle are bet preservatives for the coils.

Transformers Made Self-Cooling in Utility Shops

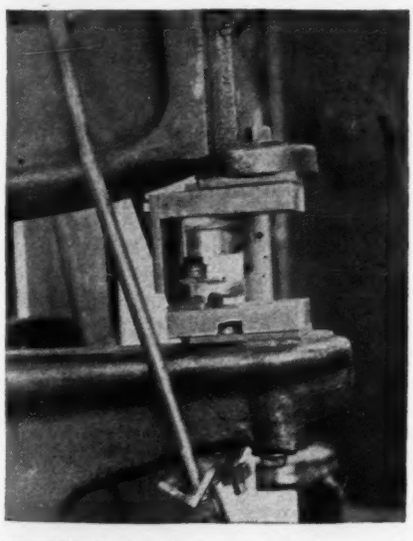
Minnesota utility designs, fabricates and installs radiators converting water-cooled transformers to self-cooled operation using own engineering and shop facilities—Avoids crowding of manufacturers' service facilities during critical period

A. F. BRADLEY, Superintendent of Construction and Maintenance, Minnesota Power & Light Co., Duluth

DESIGN, fabrication and installation of radiators for the conversion of four 2,000-kva., water-cooled transformers to self-cooling—using local engineering and shop facilities—has been achieved by the Minnesota Power & Light Co. at a total cost of $4,000.

Conversion of these transformers was one step in eliminating attendance at a 33,000- to 2,300-v. indoor substation serving a cement company in the Duluth area.

Undertaken at a time when manufacturers' facilities were crowded, the project was completed at about half the cost that would have been incurred by installing radiation provided by the makers of the transformer. On a unit basis the cost of the job amounted to $1,000 per transformer or about $0.55 per sq.ft. of radiation surface installed. Savings to the company by eliminating attendance at the substation will make it possible to "pay for" the transformer conversion in an estimated three-year period or less.



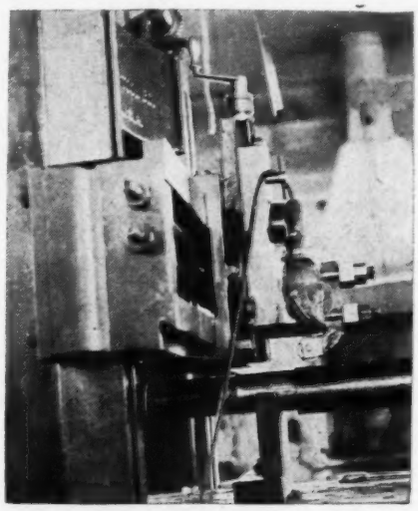
SHEARING DIE clips segment from ends of oblong radiator tubes to match curvature of header; lip on die keeps tube from crushing

Until the middle of 1941 attendance at this substation had been necessary because cooling water for this substation was pumped on for use elsewhere. Continuous delivery was desirable. Algae growth in the water had caused occasional clogging of the line with the result that the transformers ran hot. These and other system considerations influenced the conversion to automatic unattended operation.

Design Considerations

Working back from the ambient temperature obtainable in the substation with certain modifications in the ventilation scheme, the allowable transformer oil temperature rise and the heat dissipated from the tank surface, it was estimated that at a rate of 7 sq.in. of radiation per watt of loss some 1,800 sq.ft. of additional cooling surface would be required per transformers.

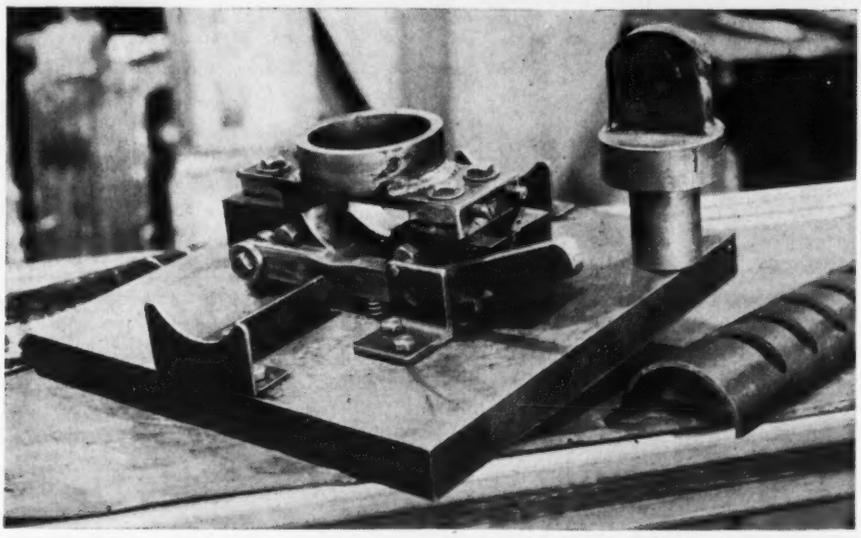
To secure this much cooling surface, 30 radiators were required for each of the four transformers. Each radiator consisted of a top and bottom header of 3½ in. O.D., 10-gage steel pipe blanked off at the outer end and welded at the other end to the oblong transformer tank which was 46 in. wide, 74 in. long and 9 ft. 10 in. high. Oval radiator tubes, welded into elliptical holes in the top and bottom header were 16-gage steel ¾x3 in. O.D. and 8 ft. $\frac{1}{16}$ in. long. It was considered necessary to use the same grade steel (SAE 1015) in the tubes, headers and welding rods in order to obtain oil tight welds.



DISK FROM plumber's pipe-cutting tool in "clapper box" of metal-working planer splits 3½ in. radiator header to facilitate punching of elliptical holes for radiator tubes

With this and other precautions, only 2 percent of the welds showed leaks on test and these were eliminated by another bead over the leak.

Tubes were spaced on 2-in. centers along the header. Because of the limitations on the length of the finished transformer, to go into the repair pit, the four radiators at each end of the transformer had fewer



PUNCH PRESS die used to make elliptical tube holes in header; spring latch automatically spaces holes at 2 in. intervals; punched half header is shown at right

tubes than those on the sides. Of the 30 radiators per transformer, 22 were 28 in. wide with 13 tubes; 4 were 26 in. wide with 12 tubes and 4 were 24 in. wide with 11 tubes each.

As shown in the drawing, radiators were spaced 9.6 in. apart, the spacing being measured midway in the width of the headers. It is obvious that the holes to be drilled in the oblong transformer tank for the radiator headers had to be more closely spaced at the ends than in the sides of the tank.

Radiator Fabrication

Success in the conversion of these transformers at low unit cost lay largely in developing dies and jigs which permitted mass production of the component parts of the radiators and assembly of them on a straight line production flow basis. Several of the special tools developed for the project are shown.

Before the elliptical tube holes could be punched in the top and bottom radiator headers, the headers had to be cut in two longitudinally on a metal-working planer. To do this, a disk and yoke from a plumber's pipe-cutter was clamped in the "clapper box" of the planer. One side of the pipe was cut at a time as it was supported on an arbor.

For punching the radiator tube holes in the headers, a special punch-press die, shown, was built. This die was provided with a spring latch which automatically spaced the holes on 2-in. centers along the pipe.

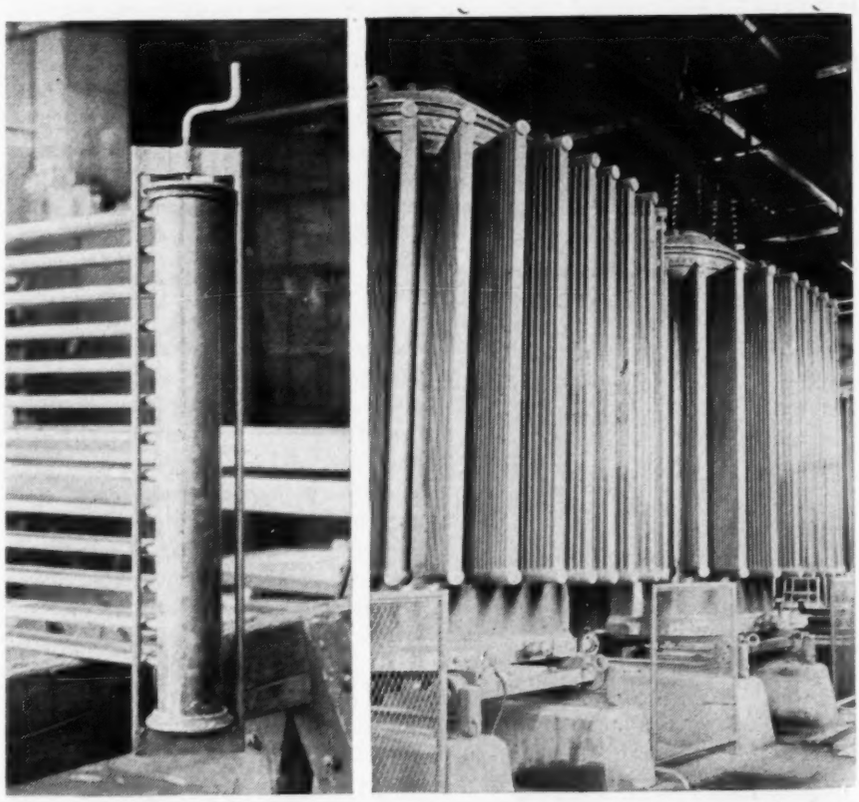
A shearing die was made up to cut circular segments from the two ends of the elliptical radiator tubes to match the curvature of the header. This die, shown, was provided with a lip that projected into the end of the tube to prevent crushing.

Radiator tubes and the punched halves of the top and bottom header were assembled in a structural steel frame which could be supported on a pipe axle from uprights bolted to the ceiling and floor. The frame served as a positioning jig while the tubes were being welded to the header halves.

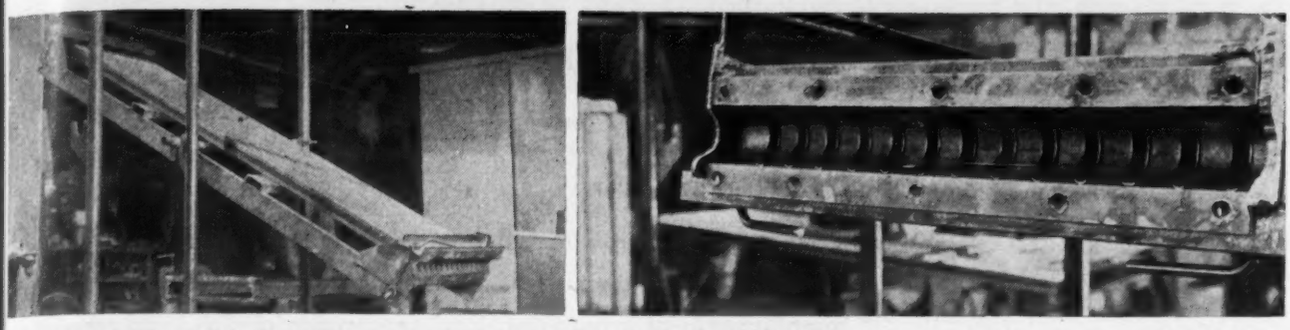
Before proceeding further with the assembly, welds were tested for leaks. This was done by closing the open halves of the radiator header (using a board covered with an inner tube and held in place with C clamps) and admitting air under 15-lb. pressure. Leaks were located by painting with a soap solution while under pressure.

Remaining unpunched halves of the header were next welded in place and one end of each of the headers closed with a disk. It was not necessary to bevel the joint in preparation for welding since a very satisfactory bevel had been made in the pipe-cutting operation. Temporary caps were next clamped on the open ends of the assembled headers and the welds of the completed radiator were given a final test with air pressure before the completed radiator was installed on the transformer tank.

Holes in the transformer tank to accommodate the radiator headers were cut with a gas torch in a com-



TESTING JIG closes ends of radiator headers for air pressure and soap test of radiator welds for leakage (left); finished transformers on foundation in indoor substation; radiators increased oil capacity of each transformer about 10 barrels (right)



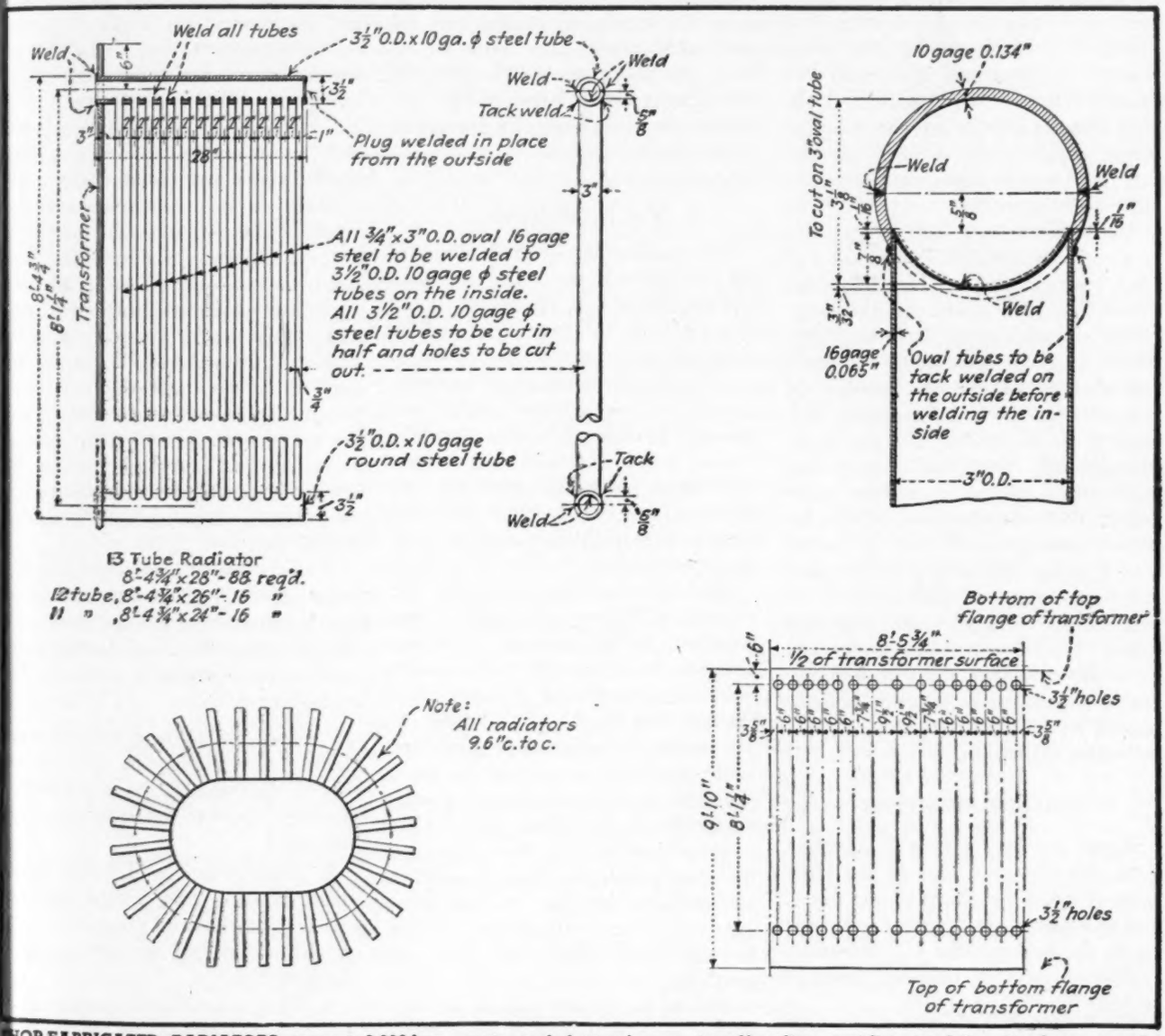
RADIATOR TUBES AND HEADERS were assembled in steel frame which did double duty as positioning jig for welding; closeup at right shows tubes and header assembled for welding

pass-type jig mounted in a ½-in. drilled pilot hole.

When all radiator headers had been welded in place, the transformer was filled with oil and inspected for leaks. The entire tank was not given a pressure test because calculations indicated that any reasonable testing pressure would cause a serious deformation of the tank and would possibly initiate leaks that otherwise would not occur.

In a few instances, internal stresses were set up during the electric welding of a tube into the header which caused a slight warping of the tube. This was easily corrected in a few seconds by softening the tube with an acetylene torch applied near the weld.

This work was carried out by the author in accordance with a design by W. F. Nottingham, electrical engineer, and has now operated more than two years with complete success.


Weld all tubes
3½"O.D.x10ga.ϕ steel tube
Weld
Weld
Tack weld
Plug welded in place from the outside
All ¾"x3"O.D. oval 16 gage steel to be welded to 3½"O.D. 10 gage ϕ steel tubes on the inside. All 3½"O.D. 10 gage ϕ steel tubes to be cut in half and holes to be cut out.
Transformer
3½"O.D.x10 gage round steel tube
Tack
Weld
13 Tube Radiator
8'-4¾"x28"-88 req'd.
12 tube, 8'-4¾"x26"-16 "
11 " ,8'-4¾"x24"-16 "
10 gage 0.134"
To cut on 3"oval tube
Weld
Weld
Weld
16 gage 0.065"
Oval tubes to be tack welded on the outside before welding the inside
3"O.D.
Note: All radiators 9.6"c.to c.
Bottom of top flange of transformer
8'-5¾"
½ of transformer surface
3½"holes
3½"holes
Top of bottom flange of transformer

SHOP-FABRICATED RADIATORS convert 2,000-kva., water-cooled transformers to self-cooling, avoiding need for attendance at substation

Criteria for Decisions on Post-war Distribution

Conversion and rehabilitation of distribution systems will require attention to wartime improvisations, pre-war standards and practices, simplification of inventories, load supervision and voltage regulation

FRANK SANFORD,* The Cincinnati Gas & Electric Company

DURING THE WAR distribution systems, particularly in the widespread residential, suburban and rural areas, have been forced into a secondary position. Substitutions of extension materials and methods, increased loading of lines and equipment beyond levels normally considered satisfactory and deferred changing to larger capacities have been necessitated and will in many cases demand immediate attention.

Meanwhile several factors that point to a considerable shift in demand and load responsibility will again focus attention on the distribution systems of the electric supply business. With resumption of household appliance manufacture, a definite increase in domestic loads can be expected. Release from brown-out, dim-out, time-change and conservation programs will contribute an intangible increment. Undoubtedly there will be intensive sales promotion of appliances and lighting. Reliable estimates place the post-war home-building figure at one million units per year for several years. With construction forces and materials available, and with building interests anxious to go, this activity should be an immediate factor in distribution expansion.

Post-War—Two Parts

These points are worthy of attention, not just as a part of the long-termed trend for the post-war years, but as a part of the task that confronts us in the first months of conversion.

Electric service industry post-war planning has two aspects: (1) A general pattern for new substations, new feeders and future expansion; (2) definite ideas for relief of overloaded lines and transformers, schedules for material purchases to be again on the basis of "ready to serve" promptly and to meet emergencies, and the immediate reemployment of personnel to restore normal maintenance and operation schedules.

War Developments

It is possible that too little attention has been given to the consideration of smaller details that are a part of the first problem of conversion. War shortages have brought a number of new developments—some of an emergency or stop-gap nature and others that may be destined to remain as substantial improvements. These methods and materials should be reviewed with the objective of retaining or dropping them as part of the first steps in post-war operation.

Any idea that has prompted and assisted in the operating job of distribution under pressure conditions deserves some careful consideration before it is discarded or superseded. On the other hand, some of these developments and emergency measures, while advanced as answers to given problems, must be seen in their proper perspective to find their place. Care must be used that in the enthusiasm for a new idea or device materials and methods that have proved themselves over long periods are not lost to view when they may again be available.

One of the broad policies accelerated by war is that of close study of new methods. Committee meetings for exchange of ideas and information have accomplished a great direct saving in individual problems. Articles and papers have described expedients and short-cuts. The result is a new fund of experience and a new interest in what others are doing—the stimulation of wider consideration. We are undoubtedly more open-minded and not so wedded to our own past practices and procedures.

There is no magic formula for evaluating the changes in materials, in methods and in standards. Safe practices and safety factors are still applicable in determining wise policies. But we have cut corners, squeezed through and reduced the margins to save material and manpower. The reserves of capacity and the margins for growth that we previously maintained have been of the utmost importance, and we have not made too serious a dent in service standards.

We can benefit most from the war lessons if we begin now to list and review systematically the practices, both old and new. We can classify them under several pertinent questions, for example:

1. What practices of pre-war were shown to be inadequate or unnecessary in the stress of the emergency—are they obsolete for extension into post-war?

2. What practices did we follow under pressure that proved economical of material and manpower, and adequate, that may be continued into the future?

3. What practices of pre-war were dropped and should be resumed as soon as possible?

*This is written from the point of view of the industry and not of a particular company. Mr. Sanford is chairman of Edison Electric Institute transmission and distribution committee.

Our first purpose in considering the scores of war emergency practices and of war-dropped practices should be to view them in the general perspective of distribution. We should not draw conclusions or drop the analysis of most of them until we have completed the review, since combinations of individual ideas may be important.

Certainly nothing that has happened in the present war period has changed the basic tests for weighing distribution practices. For each problem of material and method the three pre-war measures will still prevail:

(a) Continuity of service, effect on outage experience.

(b) Quality of service, voltage regulation and fluctuation.

(c) Cost of service, as affected by both investment and operation.

The acid test of every idea in distribution is, and must continue to be, What has this to do with delivering a continuous, steady, economical supply of electrical energy to the point of consumption?

These three measures of service will continue to be the end results of the management of materials, methods and manpower. It is in the control of these three factors that those responsible for distribution must make critical examination in considering wartime expedients in post-war practices.

Materials

In most systems our stock piles and warehouse bins are cleaned out. We have used or disposed of all the odd sizes and end lots of hardware and equipment items. Most of us have always been inclined toward the worthy practice of keeping these odds and ends—just in case they might come in handy. But many of us have also followed a practice, not quite so worthy, of engineering our lines as a tailor fits a suit. One result is a row of bins for items that vary in minute detail—the residuals of individual purchase orders for bolts of the exact length we wanted for one job, for example.

When normal supplies of conventional materials begin again to be available, we can start with industry and our own Standards for Materials. By the test of cost, we can determine that carrying two stock items where one will do is not a good post-war practice. We can make a list of standard items for stock, and use it for all lists of material—using our list instead of the whole range of items that can be made if we continue to demand them.

During the war we have been forced to work closer to the minimum of stocks. Somewhere between that minimum and a stock pile that gathers dust, and interest, there is an ample supply point. Lower total stocks of material for inventory is one wartime practice that should remain with us.

The Substitute Problem

We have considered wood as a substitute for steel in many uses under pressure of war restrictions. Actually, this was a return to wood. Much of our earlier construction was with timber, often with little need for close engineering. When we began the wider use of steel, it was necessary to apply engineering and office layout of details because steel members cannot be cut and fit readily on the job. As we returned to the use of timbers, we applied the principles of design to these newer installations. We found, in pre-war as well as war, that wood has some very desirable characteristics for electrical equipment support.

Probably one field of war-accelerated developments will not be entirely clear to us until well into the post-war period. Synthetic materials, perhaps substitutes now, may be further developed to be of great importance for insulation, for rust inhibition and for general protective coatings.

We have been ready to try almost anything under the condition of war shortages. That may seem to be opposed to the use of standards. But there should be a point of compromise where we can settle to some established details and still have an active interest in broad improvements.

Use of steel instead of copper wire has been another practice that has increased during the war. Perhaps more steel will be used in future single-customer line taps than in pre-war practice. At any rate, this question is readily considered under the tests of voltage and cost, not forgetting that cost must include the factor of life in service.

Standard Methods

Closely allied with consideration of materials are the standard practices and methods of construction and operation. Pole-top construction, conductors, guying, transformer installations, services and many other details are the subject of drawings for repeated use rather than individual layout. In many considerations of standards it is apparent that no great advantage of investment or operating cost is involved in an individual decision. We should, however, remember to multiply any small difference by the number of thousands of units involved.

A good example is the pre-war trend for adoption of transformers of the E.E.I.-N.E.M.A. standard design for direct pole mounting. This trend has been accelerated by the war shortages of bar steel for hanger hooks. Other advantages of industry standard ratings, bushings and smaller details have been more apparent than ever before.

Before the war there was an increasing interest in scheduled maintenance programs for distribution line poles, hardware and transformers. War shortages of both materials and manpower forced dropping or curtailing of much of this work. We should review these programs, and perhaps extend or resume them at an accelerated pace to make up for the lost years of war.

Load Supervision

A pre-war study of transformer load supervision methods showed 145 percent as average ratio of maximum peak load to rating permitted. However, the test results showed averages nearer to 100 percent, indicating considerable margin between normal peak load and short-time capacity. Perhaps this margin has been decreased in many areas. A review of loads and of operating results may indicate that this increased loading practice, forced by war conditions, can safely and economically be extended into post-war operation.

Another pre-war practice, which can be tested directly by our three standard measures, is that of feeder loading. During the war, we have been forced to carry more amperes through our substation equipment and feeder cables and lines. We have, in many cases, used part of the safety or growth margin we felt was essential. Perhaps we have used fans on regulators and taken full advantage of copper ratings on a temperature rise basis. It may be that we have not had the bad experience we formerly

anticipated with this full-load type operation. At any rate, a review of continuity and voltage records should be made before we discard these war expedients.

Capacitors and Regulators

The use of capacitors on distribution feeders has been accelerated as a means of making our lines serve for more load-useful amperes. They have, incidentally, given us a permanent improvement. Similarly, we have increased the use of pole-mounted voltage regulating or boosting equipment as a temporary expedient to maintain acceptable voltage, where pre-war practice may have called for new copper.

Material restrictions have forced us to drop the rules of economics in favor of the rules of least critical materials. Before we go back to pre-war comparisons, particularly in evaluating losses, we should examine our bases to be sure they reflect modern generating costs and load curves. Voltage regulators at the source or along the line, or power-factor correction at the load, are alternatives that should not be overlooked before we increase wire sizes. Losses as a part of the comparison do represent fuel cost, but investment rates for taxes and interest can replace material shortages in an influence on decisions.

Economic Justification

In fact, as we prepare our post-war budgets for capital improvements and rearrangements, we can review our pre-war tests for engineering necessity on a broader basis than has often been possible in past year-by-year programs. An accumulated list of major expansion items in distribution can be reviewed along with our accumulation of pre-war practices and war-time expedients. It is an opportunity for broad viewpoints that has seldom been equaled in scope.

There does not now appear to be any justification in assuming that we can permit a lowering of continuity or voltage service standards. Any omission of protective equipment or reduction of maintenance, made necessary during the war, should be carefully examined. Our customers have taken dependable electric service as a matter of fact through a period of shortages, delays and increased cost in nearly every other commodity and service. Post-war load building will be based on a continuation of that record.

Regardless of substitutes in materials and expedients in methods, there has been no change in the requirement for a trained group of men to operate a distribution system. Linemen, electricians and trouble-shooters must have individual trustworthiness to a higher degree than workers in production and assembly lines of factories. This fact is particularly clear when we face the emergency of storm, sleet, flood or fire. Restoration of service, a part of the measure of continuity, then depends on having available a sufficient number of the right men.

Higher Average Age

In the upheaval of war, some of our best men have left for military service and others have left for possibly higher weekly wages in war production factories. The average age of linemen, meter men and service men is higher now than it was before the war. Normal construction has been reduced, and beyond that our principal expedient to meet the situation has been to curtail maintenance schedules. In some instances we may have called in contractors' forces to supplement our own crews for construction of new facilities for war plants.

Our post-war plans are not complete until we have examined our field organization, our training and promotion ideas. Certainly any practice or change should have the essential training and continued employment as a major test for its over-all value. Contracting, purchase of assembled units, deferring maintenance or any other policy that results in a reduced force is not necessarily a good long-term practice. Our standard for decision must include prompt service and continuity of service as well as cost of service.

Departmental Co-operation

One war-time policy that may well meet any test of desirability is that of closer co-operation between supervisors and engineers in distribution and the sales and purchasing divisions of our companies. In the push to get jobs done we have often accomplished more, and more quickly, and with less letter writing and reports. Service to a plant being converted to war production could not wait. Likewise, when we could not buy what we wanted, we found a way to use what was in the storeroom, or a substitute that some one else could sell.

Perhaps our first post-war use of this latter expedient might be a review of material stock lists, setting of minimum requirements of a minimum number of items, and preparation of a basis for meeting our needs in the first months of peace. This would be a good test of our experience of operating with less. For every item, we can well ask: "Why do we need that?" Closer co-operation and co-ordination of men, materials and methods is the final objective of distribution management. Every pre-war practice and war-time expedient must fit this pattern to be worthy of priority in post-war plans.

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Farm Electrification Continues to Rise

After an increase of about seven percent to 40.8 in 1942, electrification of American farms continued, but at a slower pace, to reach 41.9 percent in December, 1943, according to preliminary figures recently released by the Edison Electric Institute. Of the states having less than 100,000 farms, New Jersey ranks highest with 93.7 percent electrified. In the group with between 100,000 and 200,000 farms, California is highest with 96.3 percent. Of those with more than 200,000, Ohio is at the top with 75.5 percent.

The Pacific Coast states have the highest proportion of farms using electric service, 87.5 percent. Next comes New England with 74.4 percent, only slightly above the Middle Atlantic group with 74.1. The East North Central region is not far behind, 69 percent. Then comes a long drop to the Mountain states which show 45.6 percent. South Atlantic is next with 36 percent and West North Central, West South Central and East South Central close the list with 32.3, 22.8 and 21.1 percent, respectively, of farms electrified.

Load Break Switches Find Wide War Plant Application

Approach to breaker performance at lower cost and saving in critical material brings load break disconnect switch and fuse combination into increased wartime industrial use in a variety of applications

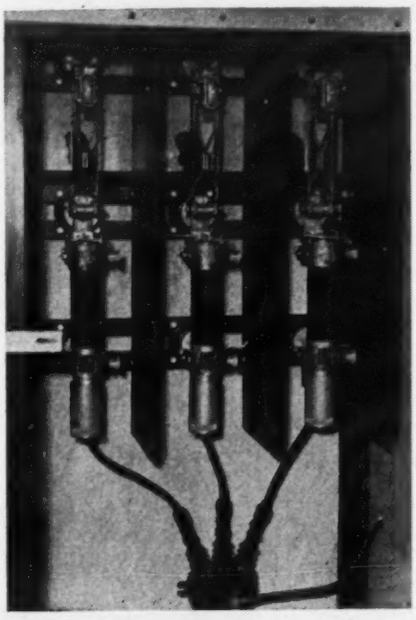
DISCONNECT switches capable of breaking load currents up to 400 amp. at 7,500 or 15,000 v. and at moderately low power factors have had an unusual opportunity to prove themselves as a result of the wide application they have enjoyed in war plants and industrial establishments. These switches are not a war development. However, their availability prior to the early "defense era" was a timely coincidence that has contributed to the rapid expansion of many new war production industries. This circumstance is no doubt due to the ability of these switches, when used in combination with power fuse short circuit protection, to approach air and oil circuit breaker performance at less cost and with notable savings in critical material.

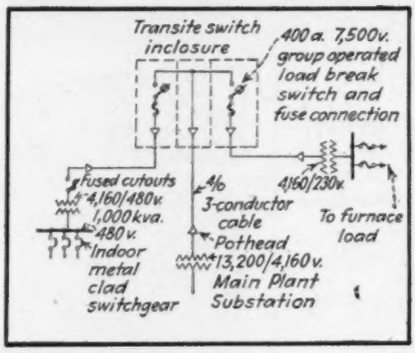
These advantages and the pressure of material scarcities have, under the influence of the priority system, drawn them into war plant applications as:

1. Primary load interrupting and fault current protective devices in factory distribution substations, in combination with power fuses.
2. Load interrupting and short circuit protective means in main distribution feeders, again in combination with power fuses.
3. Normal and emergency feeder selector switches for critical loads.
4. Bus sectionalizing switches.
5. Transformer isolating devices.

This partial listing is indicative of several of the more common uses to which these switches have been put. Accompanying diagrams illustrate these applications in "typical" industrial plants engaged in war production in the middle west.

An Indiana cartridge brass and case plant, for example, uses two three-pole, S & C type SLB 7,500-v., 400-amp. load-interrupter switches, with 400-amp power fuses, as combination feeder selector switches, primary load switching and fault current protective devices at each of four outdoor plant distribution substations, the largest of which has 2,250-kva. capacity. As the circuit diagram shows, each substation can be supplied at 6,900 v. from either of two 3-conductor, 750,000-c.m. underground cables originating on different bus sections in the switchroom. Power transformer banks step voltage down from 6,900 v. to 460 v. for use within the plant. The switches, installed between each feeder cable pothead and the transformer primary bus, were selected to permit full transformer load to be shifted from one feeder to the other. Fuse operation is coordinated with secondary breaker protection and with the feeder oil circuit breakers in the switchroom.



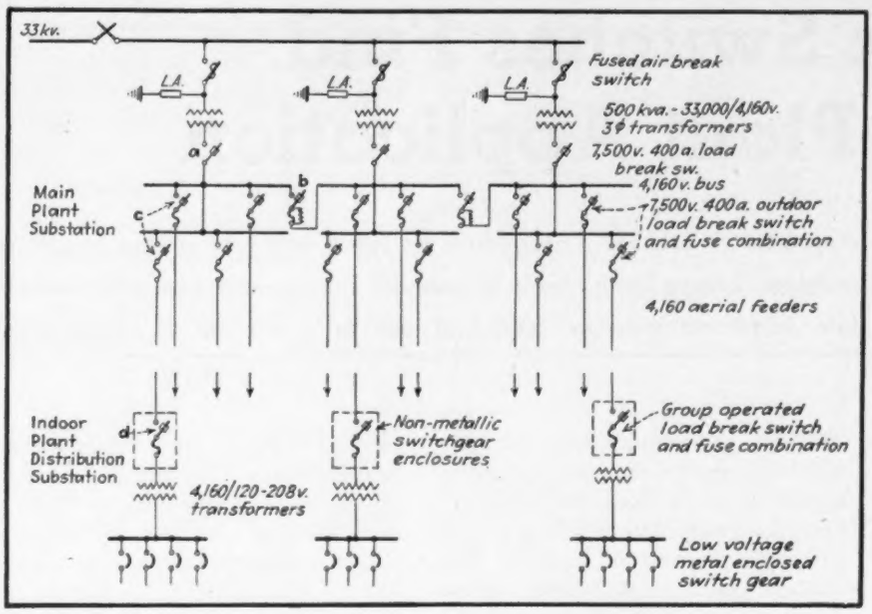


IN THIS non-metallic switch enclosure a "T" bus connector splits the main plant feeder into two sub-feeders supplying step down distribution substations. Picture shows close-up of one switch compartment

At another point in this plant, where a particular load is divided among three 6,900-v. feeders cables, three-pole, gang-operated load-break switches—without power fuses—serve as emergency feeder selector switches. The circuit arrangement is shown schematically. Six three-pole switches are arranged in pairs, back-to-back, with stationary contacts common and connected to the load. Normal operation is as shown in the drawing, with a separate feeder supplying each element of load. Under emergency conditions, however, all three load elements can be supplied from any one of the feeder cables. Load-break switches permit switching under load in emergency situations.

Load-break disconnect switches both with and without power fuses in combination are being used in a variety of applications at a large Illinois ordnance works. The general plant power supply scheme is shown in an accompanying illustration.

As the circuit diagram shows, power is supplied to the main plant substations at 33 kv. Here it is stepped down to 4,160 v. for plant distribution by three 500-kva., three-phase transformers operating in parallel. Secondary side of each


33kv.
L.A.
Fused air break switch
500 kva.-33,000/4,160v. 3φ transformers
7,500v. 400 a. load break sw.
4,160v. bus
Main Plant Substation
7,500v. 400 a. outdoor load break switch and fuse combination
4,160 aerial feeders
Indoor Plant Distribution Substation
Non-metallic switchgear enclosures
Group operated load break switch and fuse combination
4,160/120-208v. transformers
Low voltage metal enclosed switch gear

POWER SUPPLY SYSTEM for ordnance works uses load-break switches as: (a) transformer isolating devices; (b) with fuses as bus sectionalizing means; (c) as 4,160-v. feeder protection in combination with power fuses and (d) power transformer protection devices in non-metallic enclosures in indoor plant substations. Spring actuated, solenoid tripped mechanism permits remote tripping of important feeder switches

transformer is connected to the 4,160-v. substation bus through unfused 400-amp. load-break disconnect switches which, with the conventional fused disconnect switches on the primary side, permit individual transformers to be isolated from the secondary bus for maintenance or repair.

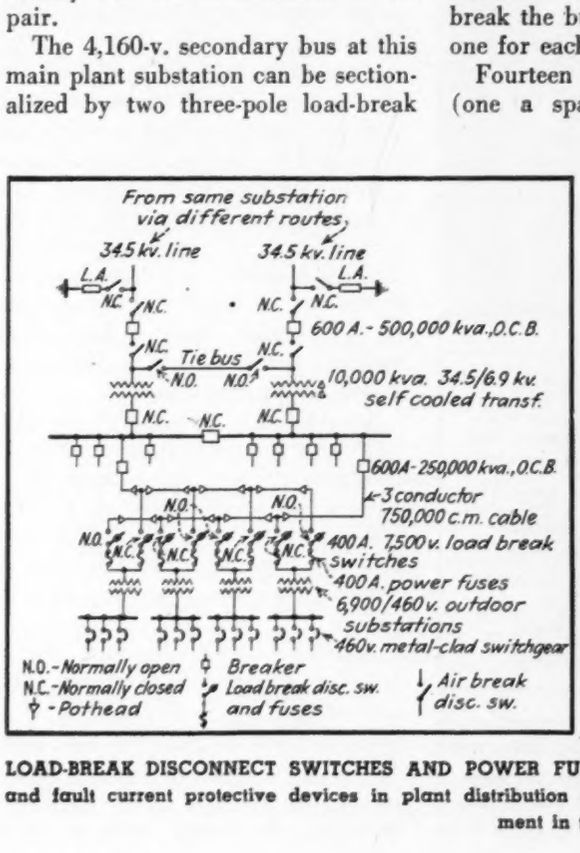
The 4,160-v. secondary bus at this main plant substation can be sectionalized by two three-pole load-break disconnect switches that have two parallel 400-amp. power fuses in combination per pole. These switches operate normally closed, with all three transformers feeding into a common bus. However, the switches function in the capacity of bus tie breakers and can be opened under load to break the bus up into three sections, one for each main transformer.

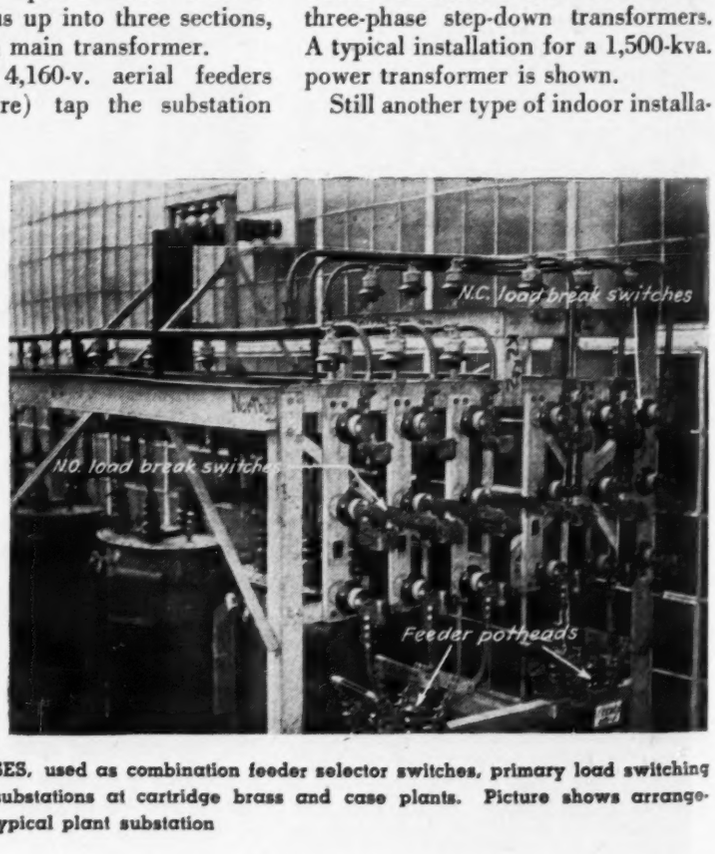
Fourteen 4,160-v. aerial feeders (one a spare) tap the substation 4,160-v. bus to supply adjacent plant power and lighting. Feeders are provided with load interrupting and fault current protective means in the form of 7,500-v., 400-amp. three-pole load-break disconnects with fuses in combination. These switches allow all or any part of the feeder load to be tripped from a given substation bus section at will.

For convenience and speed in opening feeders supplying a certain remote load during emergencies, two feeder switches are equipped for remote tripping. Spring-actuated, solenoid-tripped operating mechanisms have been installed on the switch in the main substation. Thus operators may open load-break switches at the load center by means of 110-v. push button control. It is, of course, obvious that the switches, once opened, must be closed manually.

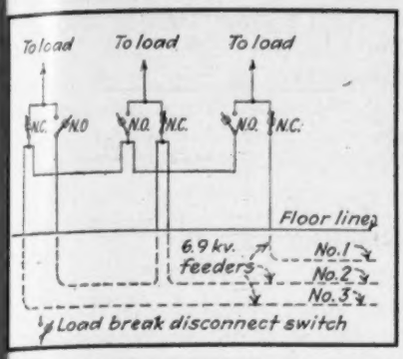
Nine plant distribution substations are located within the main plant building on balconies above the machine floor. Here transformers step the 4,160-v. distribution voltage down to 120/208 v. for lighting and power. The open-wire 4,160-v. feeders are brought in to indoor-type, 7,500-v., 400-amp., three-pole, group-operated, load-break switch and fuse combinations in non-metallic enclosures from which connections are made to the three-phase step-down transformers. A typical installation for a 1,500-kva. power transformer is shown.

Still another type of indoor installa-





LOAD-BREAK DISCONNECT SWITCHES AND POWER FUSES, used as combination feeder selector switches, primary load switching and fault current protective devices in plant distribution substations at cartridge brass and case plants. Picture shows arrangement in typical plant substation



GANG-OPERATED load break switches, capable of interrupting 400 amp. at 7,500v. arranged as emergency feeder selector switches. Circuit shows normal switch positions. In emergency any feeder cable can supply all their loads

tion of the load-break switch and power fuse combination has been employed in the new government ordnance plant near Geneva, Ill., operated by Burgess-Norton Mfg. Co. Here, as shown in the diagram, a 4/0, three-phase, three-conductor power supply cable from the plant's main 13,200/4,160-v. substation is brought into a double indoor-type non-metallic switch enclosure where by means of a T-connection the main feeder is split and sub feeders lead off through load-break switch and fuse combinations to pothead and cable connection to separate outdoor factory substations. One supplies a furnace load, the other a 1,000-kva., 4,160/480-v. transformer bank supplying general plant power needs. In the latter substation fused cutouts are provided on the primary side of the bank from which secondary connections are led indoors to conventional metal-enclosed secondary switchgear.

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Tribute to Plant Operating Crews

Reviewing the performance of British electricity supply systems under war conditions, the Electrical Review (England) has this to say about the men who operate the plants:

"They have stuck to their posts without overhead cover . . . Their efforts to get to their work in good time under raid conditions to avoid disorganization on change of shift, have been amazing. And they have paid the penalty by way of casualties which are fully comparable with those of the battlefield."

Capacitors Bolster Open-Delta Banks

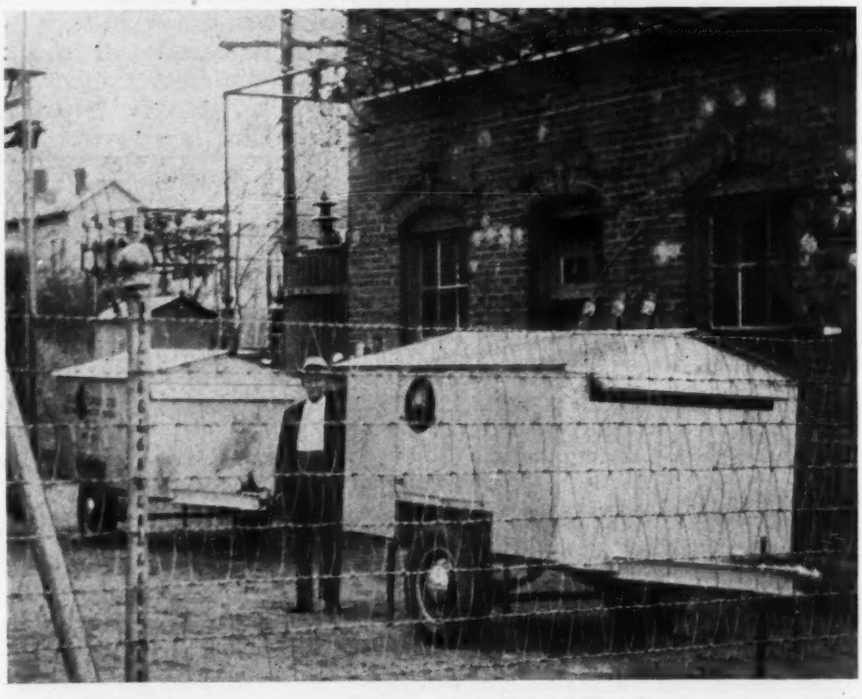
When transformer fails and bank must operate open delta, portable capacitor is brought in to reduce the secondary currents and to improve regulation

A. A. JOHNSON *

NEW AND NOVEL, yet very practical, is the use of mobile shunt capacitors in the secondary of an open-delta transformer bank to reduce the transformer loading and improve and balance the voltage regulation. With such mobile capacitors and with portable electric fans, an open-delta transformer bank can carry the same load as the self-cooled closed delta bank and in many cases with lower transformer hot spot temperatures. One large utility company has been using mobile capacitor banks, mounted on two-wheeled trailers, as spare capacity for many delta-connected transformer banks successfully for about two years. Each trailer contains a total of 540 kva. of capacitors and can be towed easily by any standard car or truck. The total weight of a trailer with capacitors is 4,600 lb.

In the event that one of three transformers, forming a closed-delta bank, must be removed from service for any reason, the mobile capacitors can be wheeled into position within a few hours to help supply the load. In this way service with unbalanced and reduced voltage is supplied for a mini-

*Central Station Engineer, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.



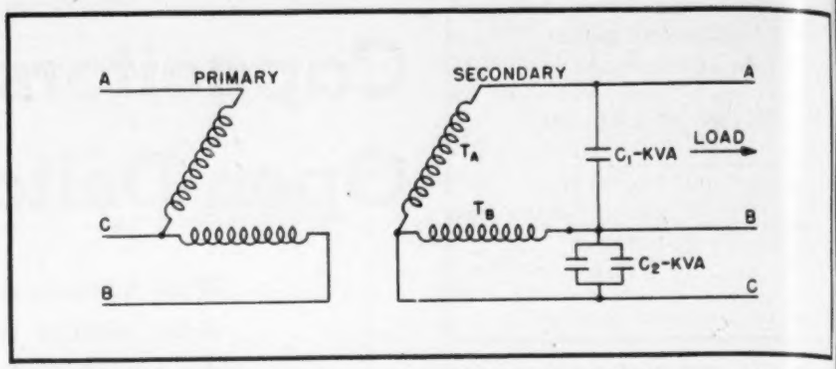
AFTER TROUBLE was reported, it took four hours and 40 minutes to move these two portable capacitors 47 miles and to connect them in, using hot clamps; the failed transformer had been cut out and service restored open delta at reduced and unbalanced voltage until the capacitors arrived

mum period of time, for, upon installation of the capacitors, normal voltage conditions are restored. This use of mobile shunt capacitors eliminates the necessity for spare transformers at points where banks are fully loaded.

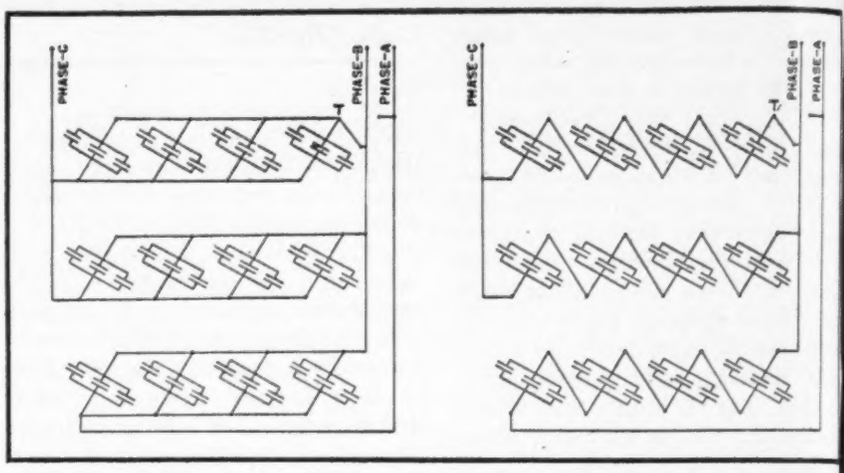
Strange as it may seem, the shunt capacitors are not equally distributed across the three phases when applied to open-delta transformer operation. Instead, in order to equalize the transformer voltage regulation in the three phases, it is necessary to connect twice as much capacitor kva. across one phase as across the open phase and zero capacitors across the other phase.

Each bank of capacitors is made up of 36 15-kva., 600-volt units insulated for 2,400 volts. Connections are provided so that they may be used either on 600-volt or 2,400-volt transformer secondaries. The terminals are so arranged that connections can be made for open-delta operation, as indicated in one of the accompanying diagrams, or they may be connected for equal distribution among the three phases for application to a closed-delta bank. The other diagram shows a schematic layout of how the connections are made for open-delta use on 600 volts and 2,400 volts. For closed-delta use the connection between terminal T and phase B must be opened and closed between terminal T and phase A.

Shunt capacitors applied to open-delta transformer banks are most effective on loads having lagging power factors of from 70 to 90 percent. The capacitors reduce the transformer currents by supplying the out-of-phase or wattless components. The tabulated data show how effective this has been on two actual system applications. For each of these two cases the load power factor was about [illegible] percent. In case 1 the transformer current in open delta was reduced [illegible] average of 42 percent per transformer and in case 2 an average of 32 per



CONNECTION of portable capacitor to open delta transformer bank



INTERNAL CONNECTIONS of 540-kva. mobile capacitor—600 volts, left; 2,400 volts, ri

Effectiveness of Capacitors in Reducing Transformer Currents

Case 1 400-Kva. Transformer per Phase	Without Capacitors		With 540-Kva. Capacitors Open Delta	Case 2 350-Kva. Transformer per Phase	Without Capacitors		With 540-Kva. Capacitors Open Delta
	Closed Delta	Open Delta			Closed Delta	Open Delta	
Load per transformer	100%	162% T_A 148% T_B	129% T_A 116% T_B	Load per transformer	100%	165% T_A 154% T_B	131% T_A 128% T_B
Transformer current, amp. 666	100% T 100% T	169% T_A 163% T_B	130% T_A 118% T_B	Transformer current, amp. 583	100% T 100% T	166% T_A 160% T_B	127% T_A 125% T_B
Transformer secondary, volts 600	97% AB 96% AC 96% BC	90 AB 96% AC 91% BC	99% AB 99% AC 101% BC	Transformer secondary, volts 600	100% AB 97% AC 97% BC	94% AB 99% AC 95% BC	103% AB 103% AC 102% BC
Phase regulation	5.7% AB 5.7% AC 5.7% BC	16.0% AB 8.0% AC 14.0% BC	3.5% AB 2.5% AC 4.0% BC	Phase regulation	4.2% AB 4.2% AC 4.2% BC	12.0% AB 6.3% AC 10.5% BC	2.0% AB 2.0% AC 2.5% BC
Hot-spot temperature With 35 deg. C. ambient	77.0 deg. C. (S.C.)		67.0 deg. C. (F.C.)	Hot-spot temperature Rise above top oil	11.0 deg. C.	23.0 deg. C.	15.0 deg. C.
Hot-spot temperature Rise above top oil	12.0 deg. C.	28.0 deg. C.	18.0 deg. C.	Hot-spot temperature With 35 deg. C. ambient	78.0 deg. C. (S.C.)		72.0 deg. C. (F.C.)

NOTE—Subscripts refer to connection diagram. S.C. = Self-cooled. F.C. = Fan cooling of tubes.

cent. In case 1 the hot spot temperature was reduced from 77 deg. C. with a closed-delta bank and self-cooling to 67 deg. C. in open delta with capacitors and fan cooling. For case 2 the hot-spot temperature was similarly reduced from 78 to 72 deg. C. The fans used for cooling were of the portable type, placed on the ground with air stream directed against the transformer oil-cooling tubes. While these two cases show lower hot-spot temperatures when using shunt capacitors and fan cooling, there have been other cases where the hot-spot temperature was greater but still within allowable maximum values.

The data also show that the secondary or load voltages on the three phases, with shunt capacitors, are practically balanced. Case 1 has a maximum difference in voltage among the three phases of only 2 percent, whereas case 2 has 1 percent. The phase regulation or voltage drop through the transformer bank was decreased in each case to about one-fourth of the value without shunt capacitors.

One or more capacitor banks of 540 kva. may be used, depending upon the size of the transformers involved. Even though a transformer bank is sufficiently large to carry the total load on open-delta operation, it may be desirable to use shunt capacitors to improve the secondary voltage.

The explanation as to what happens to the currents and voltages when shunt capacitors are added to open-delta transformer banks is somewhat involved. A general idea of what takes place is as follows. Referring to the diagram, the current taken by capacitor C_1 subtracts almost directly from the current in transformer T_A, thus reducing the load on this transformer. The vector sum of the currents in capacitors C_1 and C_2 subtracts from the current in transformer T_B at an angle of between about 30 to 40 deg., depending upon the power factor of the load. This reduces the current in transformer T_B by about the same amount as it is reduced in transformer T_A (for transformer loadings from about half to full load). At loads less than half of the transformer bank capacity the capacitors are not needed. When the currents through the transformers are reduced, they are also shifted in phase position, so that they are almost in phase with the voltage across the respective transformer windings. Thus the voltage drops through the transformers become about equal; the regulation through the bank is reduced and the secondary voltages are nearly balanced.

Since this utility company adopted mobile shunt capacitors for this type of service, they have been used ten times to relieve overloaded transformers in open-delta banks. Many hours of service have been maintained without the use of spare transformers.

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Automatic Switches Improve Continuity

Automatic air-break switches—so-called "flip-flops"—installed on either side of a 1,500-kva. substation which taps the midpoint of a 42-mile, 66-kv. transmission circuit of the Oklahoma Gas & Electric Company have, by speeding the isolation of faults, vastly improved service continuity to the important small community of Kingfisher, Okla.

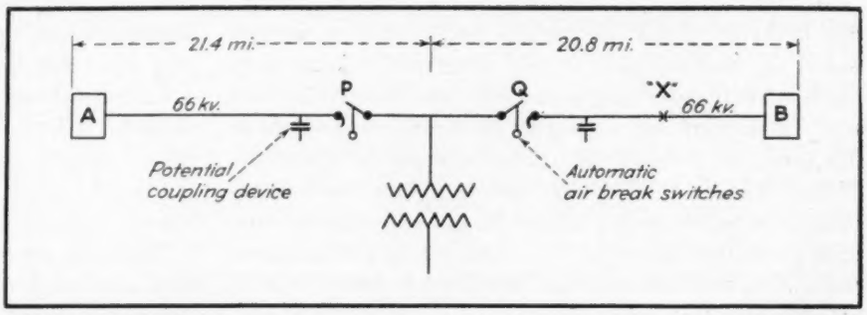
Measured from the time of initiation of a 66-kv. fault, the entire cycle of operation of these automatic switches takes one minute and 15 seconds, compared with many times that long formerly, when breakers at this substation had to be closed manually by an operator who was not in constant attendance.

Cost of the installation represents about 15 percent of that for 66-kv. oil circuit breakers to perform a similar function.

Arrangement of the automatic air-break switches in the circuit is shown in the accompanying illustration. In the event of a 66-kv. fault at "X" the automatic oil circuit breakers at both ends of the transmission circuit open and attempt at least one or two immediate reclosures. Assuming that they trip on these reclosures for a sustained fault, they remain out long enough for the automatic air-break switches to open on loss of potential. Potential detection for the switches is provided by potential-coupling devices installed on two of the three phases. When the switches have opened, both terminal breakers close again and the one nearest to the fault trips and remains out. Potential is thus applied to the coupling device controlling the "holding side" air-break switch and it closes, restoring service to the substation; the other air-break switch remains open until the fault is cleared and potential restored to that half of the 66-kv. line, when it closes.

Time sequence of these operations measured from time of initiation of the fault to restoration of service at the load is given in the following table, in which designations apply to the circuit diagram shown:

Fault at "X"	Elapsed Time, Seconds
A & B trip	0
A recloses in ½ second and trips	0.5
B recloses in ¼ minute and trips	15
P & Q open in ½ minute	30
A recloses in 1 minute and holds	60
P recloses in 4 seconds	64
B recloses in 1 minute and trips	75
B & Q remain open.	



AUTOMATIC air-break switches at semi-attended substation improve service continuity to important load; avert investment in 66-kv. breakers

Editorials

S. B. WILLIAMS, *Editor*

A Magnificent and Well Earned Tribute

THE COFFIN AWARD has for years stood as the highest honor that could be bestowed on any electric operating company. It was recognition of a superb job in management, but during the war virtually all power companies have been doing an outstanding job. They could not all be recognized individually with the Coffin Award. However, since they deserved it, the Charles A. Coffin Foundation has made the award to the industry as a whole—a magnificent and well earned tribute.

In some ways industry-wide recognition for a good war job—never too late or too little; never civilian rationing—is of greater benefit to the industry than individual awards because it gives the public an over-all picture of a contribution to the public welfare so different from that which the public for more than a decade had been accustomed to see.

The job that the railroads and shipbuilders and steel mills and airplane producers and other industries of spectacular war growth have done are well known and it will be difficult indeed for anyone to attack these industries and get away with it with the public. As the story of the war effort of the utilities is better known they, too, will get a firm place in public opinion as a reward for meritorious achievement in the war.

NEMA's New Information Center

RECENTLY NEMA, through a public opinion survey, found out that the man on the street didn't know very much about the electrical manufacturing industry, but was really interested and wanted to get better acquainted, so this week an information center was put in operation. Writers serving this renewed public interest in business have been avidly searching for facts about industry and have made the beginning of a good job in public education. Now the electrical manufacturing industry will be able to assist that group.

This is the first time that any branch of the electrical industry has set up an information center. And while it is set up primarily to give information about the electrical manufacturing branch and its products it would be strange indeed if those who use the center did not make greater demands of it.

This is a constructive move and is bound to make for greatly improved public relations that may have far-reaching effects, not the least of which may be a renewed interest in the industry by young men as a door to opportunity.

A Rate-Adjustment Plan Without a Ratchet

IN AN EFFORT to get away from long drawn out rate cases with costly valuation proceedings, the New Jersey Board of Public Utility Commissioners has proposed a rate adjustment plan with several new features.

Rate adjustment plans are not new, the best known being the Washington plan which has had a strong buffeting recently by OPA and other government bodies. Such plans are fine so long as they work in favor of the customer, but as soon as cuts cease or increases are in order, every effort is made to apply the ratchet.

This problem is recognized by the New Jersey plan and through a stabilizing reserve, most of which the company will set aside out of surplus, and the rest, up to 6 percent of the rate base, out of excess return. This reserve will make up return deficiencies and thus give the company what to all intents and purposes amounts to a rate increase when earnings are down for a short period. After the reserve is gone the company may, if it wishes, increase its rates sufficiently to earn its return.

It may be a long time before the New Jersey Power and Light, to which this plan will be applied, attempts to raise rates but in the meantime it will be in the enviable position of enjoying the nearest thing we know of to a return guarantee.

Another interesting phase of this new plan is the method of determining return. It isn't a fixed percentage but is a variable designed to cover all commitments and at the same time provide the equity interest with a high degree of stability and incentive for good management. Return provides first for the debt and preferred stock service at cost. To this is added for the common, a return based upon the average earnings-price ratio of a list of ten large utilities which is subjected to a multiplier the size of which is regulated by the ratio of common to total capital. At 25 percent this multiplier is 1.44.

And to further protect the equity holders the plan provides for a limit below which return cannot go and, for the consumers, an upper limit. Incentive is provided by sharing the excess over allowable return with the consumer but not retroactively.

There are elements in this plan, such as a depreciated first cost rate base, that will not appeal to lots of companies but there are also many other points that may prove very attractive to both sides.

One thing is most obvious, however, and that is the attempt of the commission to be understanding of the problems of the company without in any way forgetting its obligation to the public. The plan and the voluminous explanation which accompanied it were evidence of a policy that should pervade all regulation. There was no evidence of lip service to the principle that regulation should not be one-sided but should provide enough to attract capital and also recognize efficient and effective management.

Fiftieth Anniversary of Underwriters' Laboratories

WHEN MAN wrested from nature the secret of electricity he unloosed a force of boundless good for the development of civilization, but at the same time a force that had to be kept under strict control lest it destroy. This was apparent soon after man began to put electricity to work and rules were drawn up governing the public use to achieve a greater degree of safety. The rules, however, had to be backed up by dependable and uniformly safe equipment and so, in a small way, Underwriters' Laboratories were started fifty years ago next week.

While the organization in the intervening half century has grown far afield from the initial Underwriters' Electrical Bureau, the testing of electrical products, if not the largest, has continued to be one of its major activities. Evidence that it has done the job well lies in the constantly greater public acceptance of the label, or initials UL, as a symbol of safety.

Underwriters' Laboratories is not operated for profit. Any excess over its costs are returned to those paying the fees. By eliminating the profit motive the organization removed any temptation that might arise to favor any manufacturer. While mistakes may have been made, it has never been possible to doubt the integrity of the Laboratories. In this way the public and the industry have been well served.

There have been times when the Laboratories have been criticized for being too demanding. Most people, however, will admit that if there has to be a fault it is better to err on the side of more rather than less safety. On the other hand, the Laboratories have not been arbitrary. All of their standards are established by a council of the industry. The effort has been made to be realistic.

Underwriters' Laboratories have a record to be proud of on their fiftieth anniversary.

Which Tube for an Electronic Job?

ULTIMATELY, there will be a standard package to be applied to any functional job that can be done electronically, but before the art of deciding what can be done advantageously by electronic means progresses very far there will have to be progress in elementary directions. There is bound to be a considerable amount of experimentation, trial assembly, improvising and outright fumbling by the industrial electrical engineer; but before he can even intelligently know which of his functional tasks to dedicate to the electronic trial he will have to know more, far more, than he does now about tubes and electronic circuit functions. They are pretty much a mystery to him because the functions performed by resistors, varistors, couplers, capacitors, grid leaks, etc., are so different from what he knows he can do with corresponding circuit elements in 60 cycle operation.

Even taking the tubes alone, the very myriad of them and the strange nomenclature and symbolism that aureates them leave him at a loss to know where to start and what to believe. If he asks an electronic engineer there may come an indecisive suggestion about a thyratron or pliotron or something. If he concludes that the only escape is to take a full course in electronics, he could very well get discouraged and thus kill electronics aborning as far as he is concerned.

The moral is that someone before long must remove this question of tubes from the welter of hocus pocus that the receptive power engineer senses in the electronic literature and tell it to him in simple language. He feels that he can probably acquire an adequate understanding of the circuits that go with the tubes. But the tubes? Even if he never does a bit of experimenting he will at least acquire a more receptive respect for the potentialities of sound electronics as an industrial tool.

Power Sales Tomorrow

SAME AS it has always been but with more and better trained manpower. That conception of tomorrow's job in power sales is not explicitly stated in the brief report of a survey made by Ford Bates of the Nebraska Power Company which is published in this issue under the title "Power Sales Promotion and Prospects."

But it is explicitly stated in the letters of reply to Mr. Bates' inquiry, although he asked no question on it. Practically all the responders pointed out that whatever may be done in advertising and other promotional ways, the prime reliance must be on the man who is competent to talk to industrial customers in terms of the customers' problems, and that means trained men. More men will be needed because more calls will have to be made to counter competition which is generally expected to be more intense in the post-war than in the pre-war period. More important than competition, however, as a requirement for more power sales manpower, will be the big job of putting into peacetime industrial operations the new things and the improvements on old in electrical applications that have been developed so fast and so far under the pressure of war production.

Washington Comment

By R. N. LARKIN, Washington Correspondent

Slattery's Suggestions for Improving REA

NUMEROUS WITNESSES before the Senate Agriculture subcommittee investigating the Rural Electrification Administration have concluded their testimony with suggestions for the improvement of REA's future operations. Most have agreed that REA would prosper more as an independent agency than under the Agriculture Department.

Administrator Harry Slattery concurred wholeheartedly in this suggestion, but he went considerably farther than any other witness, citing other policies which he believed would improve a sorry situation. Since Slattery has been administrator of REA about twice as long as either of his predecessors, his ideas are not uninformed even if he did not have the same authority.

No Politics

Slattery's outstanding suggestion is that recommending strengthening of the REA act so as actually to prevent political activity by REA personnel. He testified bluntly that REA has been threatened by and involved in politics through activities of the National Rural Electric Cooperative Association, and added:

"If this whole cooperative movement for rural electrification is going to be . . . made a political football, all the work of these many years goes for naught."

Exactly the extent to which REA has become involved in politics at the present time the subcommittee has not yet succeeded in making clear. Probably it never will be able to spell this out minutely, but the Becker memorandum, introduced early in the hearing, be it gospel or the spurious document it has been labeled, draws an alarming picture of the possibilities if REA were to become avowedly political. It might be noted further that one of the favorite allegations against privately owned electric companies has been that they become wrongfully involved in politics. On this basis, it behooves REA to emulate Caesar's wife with a vengeance.

Common Carrier Transmission

Another of Slattery's suggestions, which drew favorable comment, was that REA be given authority to use privately owned facilities as "common carriers"—for a fee—to transmit energy from its own sources to its co-ops. This is the same wartime authority which has been granted the Federal Power Commission for administration of the "cheapest power" directive and the Southwest Power Administration so it can market Norfork and Denison Dam power. Both grants were under executive order.

Slattery suggests that there is small future in building duplicating transmission lines, adding that:

"I don't know whether REA should build heavy transmission systems on a large scale."

He agreed that the principle would "work both ways," a concession of dubious merit if REA is not going appreciably further into the construction of heavy transmission lines than it has. There can be no question that it would be uneconomic to indulge in extensive duplication of transmission systems, but the element of compulsion implied in writing the "common carrier" authority into law seems repugnant and hardly calculated to improve relations between the electric power industry and REA.

REA now has specific authority to finance construction of transmission lines. This sets the stage for the same type of arms-length bargaining over rates and transmission charges as was contemplated and achieved under the authority for REA to finance generating stations. The element of arms-length bargaining, which is supposed to be highly desirable in utility rate negotiations, will hardly be improved by giving REA a club with which to clinch arguments.

REA's Acquisition and Loans Section should be strengthened by the employment of several "high-grade" valuation engineers, Slattery believes, since acquisitions running into millions of dollars are relatively common with REA these days and stand to become more so as SEC's divestment program continues. "Careful and detailed" studies of each acquisition should be made by expert REA personnel, according to Slattery, whose testimony presented before the subcommittee was that this has not always been done.

Slattery opposes extending the life of loans to co-ops from the present 25-year limit to 50 years despite the urgings of NRECA and many of its member co-ops. He argues that the co-ops are doing very well under the present terms, that they can pay out in 25 years and have tidy systems whose titles are clear, and that they will not necessarily be "picked off" by private companies as soon as they are freed from all government lien.

Employee Policies

He suggests that employees who leave REA be prohibited from "entering private business in the same field" for a period of as much as two years and conversely that people not be employed to function in the same capacity with REA as they did in private employment, a provision which could at once be distinctly beneficial and markedly unfair. He would have co-ops pay part of the cost of the annual audit of their books which is now financed wholly by REA. He would like a change in regulations governing selection of personnel so that REA and the Civil Service Commission could confer and agree mutually on major appointees, who currently must come in through Civil Service's relatively inflexible procedure, which by no means guarantees the best possible man for a given job. Today, Slattery testified, Civil Service certifies three names, Agriculture weeds out any it prefers not to consider and gives REA its choice—if any—of those that now remain.

How much of Slattery's program will be incorporated into REA practice remains to be seen. It is obvious that under the circumstances, it will take considerably greater authority than has been left Slattery to install any of it.

NEWS OF THE WEEK

McKellar Renews Attack on TVA Before Congress

Feud with Lilienthal resumed—Amends drastically Independent Offices Appropriations Bill which gives agency its funds—House appropriation for FPC reduced—SEC fund unchanged

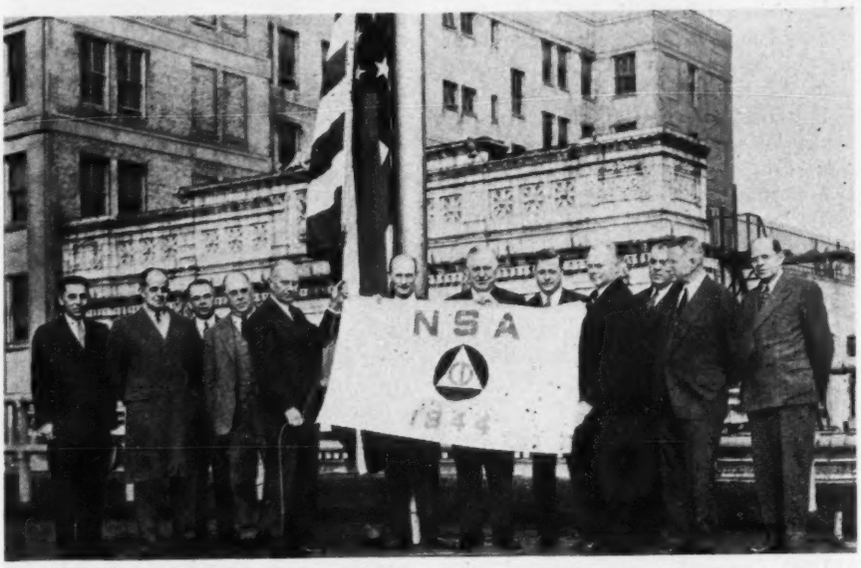
The long-standing fued between Sen. Kenneth McKellar, Tennessee Democrat, and Chairman David E. Lilienthal of the Tennessee Valley Authority was before Congress again this week in a form capable of inciting further conflict between the Administration and the Upper House.

McKellar renewed and extended his attack on TVA by amending drastically that section of the Independent Offices Appropriations Bill which gives TVA its money. As passed by the House (ELECTRICAL WORLD, February 5, 1944, page 69) the bill gave TVA no new appropriation but authorized the use of $87,791,180 in unexpended balances and current receipts anticipated through the end of the fiscal year June 30.

McKellar amended the act in committee so as to require TVA to pay all its receipts into the treasury and come to Congress annually for its appropriation, as do virtually all other agencies. A similar move by McKellar was defeated in the House several years ago, and this device has been written into several bills introduced by McKellar and Chairman Andrew May, Kentucky Democrat, of the House Military Affairs Committee, all of which have lain dormant since their introduction. McKellar then appropriated $76,981,873 for TVA in the fiscal year beginning July 1.

In reporting the Independent Offices Bill, McKellar lopped $8,000 from the amount appropriated by the House for the Federal Power Commission, leaving the appropriation at $2,766,500. The Securities and Exchange Commission item of $4,696,704 as approved by the House was unchanged in committee.

In addition to requiring TVA to turn in all its revenues, McKellar's amendments would prohibit the use of any appropriated funds for: advertising, except in case of a power shortage; location or development of sources of alumina or other minerals; purchase of lands or buildings or erection of power facilities not specifically authorized by Congress; purchase of automobiles; operation of more than 700 motor vehicles by TVA; payment of any claim against TVA other than under a court order; any political purpose whatsoever or to influence public opinion, or for or against any political candidate or for or against any legislation; payment of the salary or expenses of any TVA employee participating in any way in politics, or who attempts to influence public opinion, who works for or against any political candidate or for or against any legislative proposal; furnishing fertilizer free or below cost to anyone not approved by the county farm agent; audit of TVA's books by any private accounting firm; payment of administrative or



"FOR EXTRAORDINARY ACHIEVEMENT"—Official raising of the National Security Award flag on the roof of the main office of the Philadelphia Electric Co. The award, highest-ranking honor of the Office of Civilian Defense, was conferred on the company for "extraordinary achievement in establishing superior security and protection measures against enemy air raids, fires, sabotage and avoidable accidents." Left to right are George Fewkes, Ralph Wood, B. P. Carey, N. E. Funk, H. P. Liversidge, J. F. Calhoun, H. B. Bryans, J. A. McGuckin, John Wood, G. R. Conover, Edward Porter and J. A. English

other expenses of any contract which unjustly discriminates between TVA power users; additions to reserve funds; payment of salaries of any employee earning more than $4,500 yearly who has not been confirmed by the Senate; maintenance and repair of any aircraft not used by TVA in its mosquito control work; payment of the expenses of any principal TVA official whose principal place of business and office is not in the immediate vicinity of Muscle Shoals.

In reducing the money which TVA would have available for fiscal 1945, McKellar eliminated the $8,656,298 contingency fund which Lilienthal asked be available in case WPB restored any of its down-rated projects, and eliminated also the following items already approved by the House:

Watts Bar steam plant item, $525,000; Fort Loudon Dam item, $584,742; and transmission line facilities totaling $483,694.

Many of the minor McKellar amendments were aimed at specific practices in which the Tennesseean claimed Lilienthal was exceeding the authority of the TVA Act. The restrictions on politics for instance, grew out of the Senator's contention that Lilienthal toured Tennessee giving political speeches against him. The prohibition on payment for private audit grew out of McKellar's insistence that the act does not allow funds for audit other than that required by the general accounting office. Almost every one of the 16 specific prohibitory amendments has a similar background.

How far McKellar's program of attrition against TVA will get on the floor is problematical. McKellar is popular in the Senate and strongly affiliated with the southern bloc which controls important committees and which has recently been outspoken in its condemnation of the administration and its executives branches. The TVA amendments could be fought out along the lines laid down in the Barkley revolt over the tax veto and furthered a little by the REA investigating committee's short-lived fight over contempt proceedings against Presidential Aide Jonathan Daniels.

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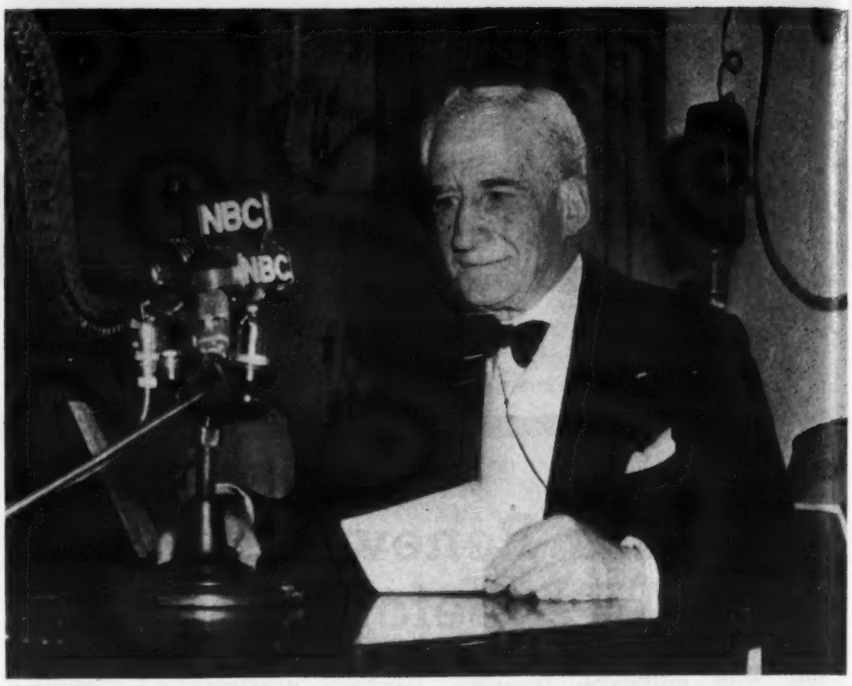
WPB Approves REA Line

Approval for construction of 40 miles of electric power line in the vicinity of Lebanon, Ore., at a cost of about $40,000, recently was granted the Rural Electrification Authority by the War Production Board. Prior to the war about 411 miles of line in Linn county, Ore., were approved and ready for construction, but work was halted. The present project will start at the Bonneville substation at Albany.



"HATS OFF"—This gesture of respect was requested for "the people who produce your electric light and power" by Gerard Swope, president of the General Electric Co., when the Charles A. Coffin Foundation award was made to America's electric light and power industry over the air last Sunday night. Mr. Swope, chairman of the board of trustees for the foundation, read the citation and made a brief address on the G-E All Girl Orchestra program

Power Industry Gets Special Coffin Award

Instead of making the Coffin Award to a single company as has been the practice in past years, the Charles A. Coffin Foundation awarded a special citation to the entire American electric light and power industry over the air last Sunday night for its outstanding war achievements. The citation, which was read by Gerard Swope, chairman of the board of trustees for the Foundation and president of General Electric Co., reads in part as follows:

"Faced with unprecedented demands, the electric light and power industry has met every war-production requirement without delay and without impairment of its peace-time services to the public. This achievement merits the appreciation not only of American industry but of the entire nation."

Mr. Swope, after pointing out that no other country has as much power for industry either in total or per worker, or so abundant a supply for the home, said:

"This appreciation will be echoed by the men at the front who are using the products made possible by the never-failing supply of electric power, and recognized by the people at home, who in these difficult days still have the comforts and conveniences that an adequate supply of electricity gives them and, in sharp contrast with almost anything else they are using, at unit prices lower than they have ever been in the past.

"Hats off to the people who produce your electric light and power."

During the past week the country was blanketed by General Electric with advertisements in daily and weekly newspapers announcing the citation.

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Boiler Specifications Amended by WPB

Order L-299, governing specifications of power boilers, has been brought up to date by WPB with an amendment providing that sidewall gauges shall not exceed the minimum thickness requirements contained in Section 1 of the American Society of Mechanical Engineers' boiler construction code, 1943 edition, including addenda and interpretations (including case 968) which were issued prior to January 15. Previous specifications were based on the 1940 edition and addenda and interpretations issued prior to July 1. Case 968 defines safety factors for design of power boilers.

Wickard Testifies at R.E.A. Probe

The Senate Agriculture subcommittee's investigation of the Rural Electrification Administration was in a "sweetness and light" phase again this week after Agriculture Secretary Claude R. Wickard testified in detail on his actions relevant to improving administration of the agency.

Wickard opened his statement with an expression of "profound respect" for the "great public service that Harry Slattery has rendered," but went on to say that it was his belief that "the REA program would be benefited if the head of the organization were a person of greater administrative ability." He said he had, with presidential approval, attempted to negotiate the appointment of Director James P. Pope of the Tennessee Valley Authority as REA administrator while Slattery was to take over as a TVA director. The plan died with Pope's refusal to make the change.

Wickard testified that while he approved in general of the National Rural Electric Cooperative Association, he had instructed all Agriculture personnel not to help organize or promote it and that he had attempted to keep the department's relationship to it a proper one. He said he had approved Slattery's April 19, 1943, "Stop, Look and Listen" letter to co-operatives advising them to go slowly in financing NRECA's two insurance companies. Wickard added that he had replied to a complaint by Clyde T. Ellis, general manager of NRECA, relative to his stand on NRECA's insurance activities by warning Ellis that he would operate the Agriculture Department as he saw fit.

Wickard said his June 17, 1943, request for Slattery's resignation had, with the consent of the President, been a request that Slattery take the job of advisor to the Administrator, so that his (Slattery's) wide experience could be available while the administrative burden rested upon another man. On Slattery's refusal, Wickard went on, he appointed William J. Neal as deputy with broad power so that someone could replace Craig, whose resignation last May left unattended a heavy administrative burden.

Wickard said he had discussed Neal's qualifications with Chairman Leland Olds of the Federal Power Commission; Master Albert Goss of the National Grange, a New Hampshire AAA official and Ambrose O'Connell, vice-chairman of the Democratic National Committee. To repeated questions by Sen. George D. Aiken, Vermont Republican, as to possible political implications in his conference with O'Connell, Wickard insisted that Neal's appointment had not been a political one.

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AA-3 Rating to Obtain Fractional Hp. Motors

Electricians, electrical contractors and appliance repairmen may use the AA-3 preference rating assigned by CMP Regulation 9A to obtain fractional horsepower motors from dealers, wholesalers or motor agencies.

Any dealer, wholesaler or motor agency is required to honor AA-3 ratings from repairmen if the motors in their stocks are not needed to fill higher rated orders. Only those fractional horsepower motors needed to replace broken motors may be sold without rating, and these motors so replaced must be taken in exchange to be repaired and resold under similar conditions. Dealers may not demand an old motor as part of the sale made on an AA-3 rating, however.

Repairmen were urged to repair broken motors as rapidly as possible to alleviate the shortage of motors for appliances.

Write-Offs Allowed on War Expansion

In an order directing the Vallejo, Electric Light & Power Co. to reduce its overall rates 18.4 percent, the California State Railroad Commission recently established its policy with respect to possible losses to war swollen populations on war time service.

Population of Vallejo, served by the company, has jumped to about 100,000 with the influx of workers to the Mare Island Navy Yard, and the commission estimated the company's total sales for 1943 at 35,000,000 kw.-hr. with gross revenue of over $730,000.

Rate reduction ordered for the company amounts to $135,000 a year.

Establishing its view on cost of meeting added emergency services, the commission specified that the company may write-off certain costs of supplying defense housing over a three year period. In making a distribution of the $135,000 total reduction, the commission also provided that $65,000 should be applied in the form of a discount on each bill. This would allow flexibility for change in case loss varying from estimates should be realized. A higher than necessary rate of return in the commission's opinion was allowed be-

NEMA INFORMATION CENTER LAUNCHED—Establishment of a new service bureau as a central source of information about its industry was announced by the National Electric Manufacturers Association at a reception and press conference at the Biltmore Hotel, New York. Left to right are W. J. Donald, managing director of NEMA, and Leonard Kebler, president of NEMA, who outlined the objectives of the Center, and C. W. Higbee, chairman of NEMA's Public Information Committee, which is supervising the program

cause of future uncertainties of the federal housing load.

The commission, in a precedential proceeding, also held that the company's rate of depreciation has been excessive. It ordered the charging to future utility customers of only such depreciation as is necessary after reducing the base by the amount of now unexpended depreciation reserve. The commission took the position that when the entire cost of depreciable investment has been returned to the owner, no further contribution for depreciation should be exacted from the utility customer. Basis for the commission's findings were U. S. Supreme Court determinations in the Hope Gas case.

Commission President Richard Sachse, in a separate study of taxes, indicated that the rate order will remove the company from the excess profits tax bracket.

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M. O. Troy Dies

Matthew O. Troy, commercial vice-president of the General Electric Co., died on March 13 aboard a New York Central train en route to Schenectady. He was 71 years old. Mr. Troy had been connected with General Electric since 1897. In the course of his distinguished career, he brought a high degree of leadership in both technical and commercial fields. He had taken out more than thirty patents covering transformers, regulators, lightning arresters, mercury arc rectifiers and capacitors.

Southeastern Utilities Honored by Military

Co-operation given Army and Navy during war lauded at Atlanta conference—Power made available on time and in ample quantities, General asserts—Rex I. Brown presided

The assistance rendered by utility companies in the Southeast to the War and Navy Departments and to the Maritime Commission during the war was highly praised at the Utilities Wartime Aid Conference held recently at the Ansley Hotel in Atlanta, Ga.

The feature of the program was the addresses by Major General F. E. Uhl, commanding general, Fourth Service Command, Atlanta, Ga., Brig. Gen. J. S. Bragdon, service command engineer, Atlanta, and Admiral J. T. Mathews, superintending civil engineer, Area IV, New Orleans, La.

Rex I. Brown, president of the Mississippi Power & Light Co., presided, and contributions to the discussions were made by J. M. Barry, vice-president and general manager, Alabama Power Co.; S. P. Vecker, vice-president, Carolina Power & Light Co.; R. B. Roberts, general sales manager, Florida Power & Light Co., with Charles A. Collier, vice-president of the Georgia Power Co., delivering the closing remarks.

General Uhl warmly praised the utility wartime aid program, declaring that the electrical utilities had created a "splendid agency for the type of co-operative planning that we need." The general declared that when this war is over and the story is told, "America's war effort will, I believe, go down in history as one of the great sagas of human accomplishments."

General Bragdon, whose address was delivered by his executive officer, Lieut. Colonel W. Z. Bancroft, asserted that "this is a tribute to free American enterprise accepting a responsibility and putting forth maximum effort to assist its government in an unusual situation created by the greatest construction program this county has ever undertaken." The general said that the construction program in the Fourth Service Command area (airfields, cantonments, ordnance plants, hospitals, etc.) cost approximately $2,000,000,000. War Department installations in this command consume approximately 1,000,000,000 kw.-hr. of electricity, he said, and the fact that the utilities made the power available on time and in ample quantities was a material accomplishment.

Admiral Mathews gave a talk on the work done in his area.

LAUDS DIXIE UTILITIES—Tribute was paid to the electrical utilities in the Southeast at the Utilities Wartime Aid Conference in Atlanta attended by more than one hundred high ranking Army and Navy officials and utility executives. Left to right: C. A. Collier, Georgia Power Co.; J. M. Barry, Alabama Power Co.; C. C. Curtis, Savannah Electric & Power Co.; P. S. Arkwright, Georgia Power Co.; R. I. Brown, Mississippi Power & Light Co.; Admiral J. T. Mathews, superintending civil engineer, Area IV, New Orleans; D. L. Sullivan, national co-ordinator, Utilities Wartime Aid Program; Maj. Gen. F. E. Uhl, commanding general, Fourth Service Command; E. L. Godshalk, South Carolina Power Co.; A. E. Jones, Tide Water Power Co.; C. E. Ide, East Tennessee Light & Power Co.; L. C. Parks, Gulf Power Co.; C. S. Thorn, Birmingham Electric Co.; S. Paul Vecker, Carolina Power & Light Co.; O. J. Miller, Duke Power Co.; H. E. Simpson, Florida Power & Light Co.

NARUC Committee Holds Depreciation Conferences

Utility representatives oppose report conclusions and offer substitute proposals that would maintain undepreciated rate base while recognizing consumers' interest

Straight line depreciation accounting for public utility companies is the most practicable and desirable method which has been suggested to date, Ganson Purcell, chairman of the Securities and Exchange Commission, told the Depreciation Committee of the National Association of Railroad and Utilities Commissioners last week at a meeting held in the offices of the Illinois Commerce Commission, Chicago.

Commenting on the committee's 1943 depreciation report, Purcell said that the SEC was "in unanimous agreement with the principal conclusions and recommendations set forth."

Stability Stressed

In stating the SEC position on straight line depreciation accounting, Commissioner Purcell asserted that it "affords greater financial stability to the business unit and greater financial security to the investor than retirement or compound interest methods. The direct financial effect of the larger straight line reserves as compared with compound interest reserves is to reduce the amount of securities that would otherwise be outstanding against the assets of an enterprise throughout its life. We therefore, believe that the change-over to straight line depreciation accounting will afford a greater protection to the financial integrity of the public utility companies and thereby strengthen their credit standing."

Purcell recognized that the problems of change-over from retirement to straight line depreciation accounting have caused utility spokesmen to express considerable apprehension lest the change-over be required in an unduly abrupt manner with adverse effects upon the credit of the companies. For this reason the SEC has, according to Purcell, "tended to require a gradual rather than an abrupt change over to straight line depreciation."

Purpose of the Chicago meeting of the NARUC Depreciation Committee was to receive the views of various state and federal regulating commissions with respect to the committee's comprehensive 1943 report on depreciation. Chairman of the committee is Nelson Lee Smith, commissioner of the Federal Power Commission.

Representatives of 18 state commissions from all parts of the country were present at the two day meeting as were representatives from FCC, FPC, ICC, TVA and NARUC.

Utility Conference

A similar conference was held by the committee in New York City early in February to receive comments from utility and investment interests, all of whom indicated opposition to two conclusions in the committee's report, (a) that resumes based on straight line theory represent at any given time the actual depreciation and (b) that necessary corrections in depreciation reserves to adjust to straight line should be made through surplus or a special section of the income account.

Representatives of the American Institute of Accountants criticized the first conclusion as confusing a method of presenting costs with actual depreciation. While admitting using the straight line method in accumulating reserves, telephone company representatives would not admit that such reserves represented existing depreciation.

An analysis from reports representing approximately half the gas utility business of the country indicated that if those companies were to carry out the proposed reserve adjustment they would have a red surplus of $313,259,300 to offset, which would require a capital reduction of about 12 percent after wiping out all surplus.

Edison Electric Institute offered a substitute program covering size of reserve, and annual and interest credits to reserve. The size of a company's reserve would be determined from a consideration of pertinent facts, such as

(a) Its retirement costs history

(b) Present accumulated reserves and credits over a period of years

(c) Character, age and physical condition of the property

(d) Past and prospective rate of growth

(e) Area economic conditions

(f) Development of the art

(g) Storm and other casualty loss liability

(h) Court or regulatory authority requirements

After establishing optimum requirements in percent it should be maintained, subject, however, to review by annual credits with consideration for the charges for retirements made and provisions for property growth. Inadequate reserves should be increased gradually so as not to harm credit.

Interest credits to the reserve should be allowed with consideration for the fact that these are trust funds. The rate will not, therefore, be as high as rate of return.

In this manner the EEI suggestions were claimed to recognize the consumers' interest in the depreciation reserve but would obviate the necessity of deducting depreciation in establishing a rate base.

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House Passes Bill Extending REA Act

Legislation authorizing the continued existence of the Rural Electrification Administration after the June 30, 1946, deadline written into the original act was before the Senate Agriculture Committee this week after having been passed by the House.

The extension of REA's life was contained in the Pace bill (ELECTRICAL WORLD, March 11, 1944, p. 4) which was introduced to eliminate numerous parliamentary tangles which had snarled House action on the Agriculture bill for the past several years.

Previously, REA and numerous other appropriations had been stricken on points of order on the House floor because they failed to have authorization. Authorization for an appropriation must precede the legislative action of appropriation. REA's authorization to borrow from the Reconstruction Finance Corp., had expired without renewal in 1939, and attempts since that time to give it authority to borrow from RFC had been stricken on points of order as legislation in appropriation bills. Other items rectified in the Pace bill never had authorization.

Some legislative observers speculated as to whether the Senate Agriculture committee would act upon the Pace bill before conclusion of the REA investigation. They pointed out that the committee gives every indication of recommending, when the probe has been completed, that REA revert to independent status. A bill for that purpose conceivably would be vetoed. Thus, these observers argue, a rider on the Pace bill returning REA to independent status would have considerably better chance of Presidential approval.

Business-Attracting Campaign Launched

A national advertising campaign, in magazines and eastern newspapers, to attract employment-giving industries to the State of Washington in the post-war period, will be launched in April by the four principal electric companies serving that state.

Announcement of the campaign was made in a joint statement released by Frank McLaughlin, president of the Puget Sound Power & Light Co.; L. T. Merwin, president, Northwestern Electric Co.; Paul B. McKee, president, Pacific Power & Light Co., and K. M. Robinson, president, Washington Water Power Co.

Mr. McLaughlin, speaking for the co-operating power companies, said: "This national advertising campaign will have a four-fold purpose: (1) to help those who now have jobs keep them in the post-war period; (2) to create employment for returning war veterans; (3) to help business and industries retain and expand in the future the progress they have made; (4) and to avoid the possibility that our many war industries will become 'ghost-plants'.

"The theme of the advertising campaign will be—'Washington—the State—has everything!' Nationally known publications will comprise one part of a double promotional campaign for the state. . . . In addition, a direct mail campaign will supplement the publication advertising. Periodical mailings will be sent to a select list of 10,000 leaders of business and industry throughout the United States, telling the story of Washington and its future possibilities . . ."

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Second Strike Averted at Los Angeles Plant

Threats of a second strike in municipally owned Los Angeles Department of Water and Power were dispelled recently when a majority of the 5,759 employees voted against strike action until such time as Manager H. A. Van Norman and representatives of the International Brotherhood of Electrical Workers, AFL, have an opportunity to work out a new wage scale.

Mayor Fletcher Bowron, who had refused to treat with strikers while they were off the job, immediately announced that a speedy solution to the wage problem would be reached.

"Now that the employees of the Department of Water and Power have determined to stay on the job we will demonstrate that we will be fair with them," he stated.

Indications were also given that union leaders had scaled down their $15 higher wage demand to a $10 per month increase. The Department of Water and Power had granted a $5 raise.

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Revenue Bonds Approved for Second Time

Members of the Finance Committee of the Missouri Constitutional Convention for the second time in five weeks have approved a proposal authorizing cities and towns of Missouri to issue revenue bonds by a majority vote for the purchase or construction of municipal utilities.

The latest vote, taken Feb. 29, was seven to four for the proposal. At present the state constitution requires a two-thirds majority for the passage of such bond issues. The minority were unsuccessful in their efforts to put through an amendment calling for a two-thirds vote and later for a four-sevenths majority vote to pass such bond issues.

Adequate Wiring Ready for Post-War

So far as availability of materials—wire, boxes, fittings and devices—is concerned, installation of adequate wiring can begin immediately the demands of war end. So stated A. E. Schanuel, Adequate Wiring Bureau, to a group of editors of trade, home-making and women's magazines at a meeting in New York March 9. The reason for this condition is the fact that manufacturers of wiring materials are making the same products for war as they did for peace and they will not be faced by any difficult problems of conversion. Also their output has been greatly expanded and when the war ends they will have productive capacity amply sufficient to meet any demands.

The occasion of the meeting was to present a direct mail program available to the electrical trade and consisting of four letters and enclosures for mailing to architects, builders, financing agencies, etc. The four mailings answer questions as to post-war availability of wiring materials, possible changes in wiring methods and possibility of increased wiring costs.

MEETINGS

Previously Listed

National Rural Electric Co-operative Association—Annual conference, Stevens Hotel, Chicago, Ill., March 20-21. Avery Moore, secretary, 416 5th St., N. W., Washington, D. C.

Southeastern Electric Exchange—Engineering and operation section, Henry Grady Hotel, Atlanta, Ga., March 23-24. John W. Talley, executive secretary, 303 Haas-Howell Bldg., Atlanta 3, Ga.

North Central Electrical Industries—Second war conference sponsored by electrical trade groups, St. Paul Hotel, St. Paul, Minn., March 26-28. W. A. Ritt, secretary-manager, 234 Foshay Tower, Minneapolis, Minn.

American Society of Mechanical Engineers—Spring meeting, Hotel Tutwiler, Birmingham, Ala., April 3-5. Ernest Hartford, executive assistant secretary, 29 West 39th St., New York 18, N. Y.

Edison Electric Institute — Annual commercial meetings, Edgewater Beach Hotel, Chicago, Ill., April 3-5. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York 17, N. Y.

Missouri Valley Electric Association—Engineering conference, Continental Hotel, Kansas City, Mo., April 6-7. I. D. Pettegrew, director, 1527 Sharp Bldg., Lincoln 8, Neb.

National Association of Corrosion Engineers—Annual conference, Rice Hotel, Houston, Texas, April 10-12. O. C. Mudd, acting secretary-treasurer, c/o Shell Pipe Line Corp., Box 2648, Houston 1, Texas.

Electrochemical Society—Spring meeting, Hotel Pfister, Milwaukee, Wisc., April 12-15. Colin G. Fink, secretary, Columbia University, 3000 Broadway, New York 27, N. Y.

Midwest Power Conference—Palmer House, Chicago, Ill., April 13-14. Stanton E. Winston, director, Illinois Institute of Technology, Chicago, Ill.

American Institute of Electrical Engineers—Northeastern district, Hotel Statler, Boston, Mass., April 19-20; national technical meeting, Jefferson Hotel, St. Louis, Mo., June 26-30. H. H. Henline, national secretary, 33 W. 39th St., New York 18, N. Y.

Missouri Association of Public Utilities—Annual meeting, Jefferson Hotel, St. Louis, Mo., April 19-20. Jesse Blythe, assistant secretary, 101 West High St., Jefferson City, Mo.

National Electrical Wholesalers Association—Second war conference, Stevens Hotel, Chicago, Ill., April 19-22. C. G. Pyle, managing director, 500 Fifth Ave., New York 18, N. Y.

National Electrical Manufacturers Association—Spring meeting, Palmer House, Chicago, Ill., April 24-27. W. J. Donald, managing director, 155 East 44th St., New York 17, N. Y.

Illuminating Engineering Society — Southwestern regional meeting, Hotel Baker, Dallas, Texas, April 25; V. J. Graham, regional vice-president, General Electric Co., 1801 N. Lamar St., Dallas 2, Texas. Great Lakes regional meeting, Cincinnati, Ohio, May 20; G. R. Baumgartner, regional vice-president, General Electric Co., Nela Park, Cleveland 12, Ohio.

National Fire Protection Association — Annual meeting, Benjamin Franklin Hotel, Philadelphia, Pa., May 8-11. R. S. Moulton, technical secretary, 60 Batterymarch St., Boston 10, Mass.

Pacific Coast Electrical Association — Northern section, Fairmont Hotel, San Francisco, Calif., May 10; southern section, Ambassador Hotel, Los Angeles, Calif., May 17. Victor W. Hartley, managing director, 601 W. Fifth St., Los Angeles, Calif.

Arkansas Utilities Association—Annual convention, Marion Hotel, Little Rock, Ark., May 15-16. R. E. Ritchie, secretary, P.O. Box 551, Little Rock, Ark.

Output Rises 12.2% Over 1943 Point

The output curve decreased rather sharply for the week ended March 11, 1944, according to figures released by the Edison Electric Institute. The amount of electrical energy distributed by the light and power industry during the week came to a total of 4,425,630,000 kw.-hr., as compared to the figure of 4,464,686,000 kw.-hr. for the week previous, which ended on March 4, 1944. Figures for the week represented an increase, however, of 12.2 percent over the 3,944,679,000 kw.-hr. distributed during the corresponding week a year ago. The output for the similar week two years ago was lower, the total being only 3,357,444,000 kw.-hr.

All of the seven major geographic regions of the country reported increases for the week, the Pacific Coast region continuing to lead the field with an individual gain of 27.2 percent. The Mid-Atlantic group took second place from the Southern States region with an increase of 12.6 percent, while the Southern group showed an increase of 11.2 percent, taking third place. There was little variation in the figures reported by the other sections. New England reported a gain of 7.0 percent; Central Industrial showed an advance of 8.9 percent and the West Central group reported a gain for the week of 5.7 percent.

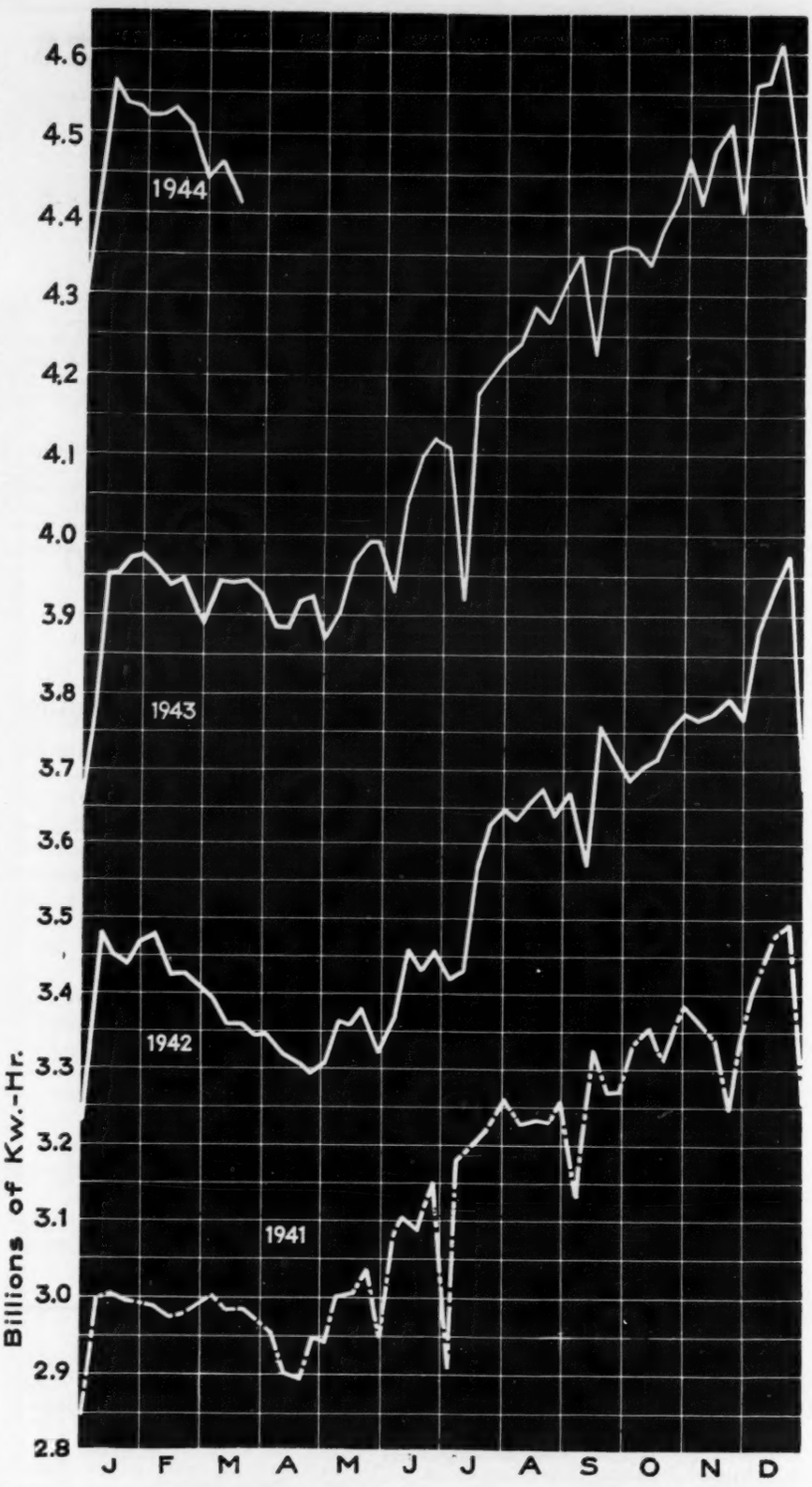
Weekly Output, Millions Kw.-Hr.

1944		1943		1942	
Mar. 11	4,426	Mar. 13	3,945	Mar. 14	3,357
Mar. 4	4,465	Mar. 6	3,947	Mar. 7	3,392
Feb. 26	4,444	Feb. 27	3,892	Feb. 28	3,409
Feb. 19	4,511	Feb. 20	3,948	Feb. 21	3,423
Feb. 12	4,532	Feb. 13	3,939	Feb. 14	3,421
Feb. 5	4,524	Feb. 6	3,960	Feb. 7	3,475
Jan. 29	4,523	Jan. 30	3,976	Jan. 31	3,468
Jan. 22	4,531	Jan. 23	3,974	Jan. 24	3,440
Jan. 15	4,539	Jan. 16	3,952	Jan. 17	3,450
Jan. 8	4,567	Jan. 9	3,952	Jan. 10	3,473
Jan. 1	4,300*	Jan. 2	3,780	Jan. 3	3,289
1943		1942		1941	
Dec. 25	4,295	Dec. 26	3,656	Dec. 27	3,234

Percent Change from Previous Week

	Week Ending Mar. 11	Mar. 4	Feb. 26
New England	+ 7.0	+ 8.4	+ 7.5
Mid-Atlantic	+12.6	+12.5	+13.8
Central Industrial	+ 8.9	+ 8.8	+10.5
West Central	+ 5.7	+ 6.4	+ 7.1
Southern States	+11.2	+13.4	+14.4
Rocky Mountain	+ 5.6	+ 7.2	+ 9.4
Pacific Coast	+27.2	+29.3	+29.5
Total United States	+12.2	+13.1	+14.2

* Subject to revision.



Columbia River Power Survey to Be Made

A broad survey of the waterpower and other resources of the Columbia River and its tributaries will be undertaken by the international joint commission at the request of the Canadian and United States governments, Premier Mackenzie King announced in the Canadian House of Commons.

Premier King said the task was the largest the commission had yet undertaken and will probably require considerable time and the employment of a number of Canadian and American engineers and economic experts.

The waterways involved in the survey drain a large part of southern British Columbia and four states—Washington, Idaho, Montana and Oregon. Recommendation will be made by the commission on how the resources of the river system may be developed to give maximum service to people on both sides of the international border.

SEC DECISIONS—HEARINGS

The Securities and Exchange Commission, in a series of orders issued last week affecting electric utility companies:

APPROVED THE PLAN of the Commonwealth & Southern Corp. to pay a dividend of $1.25 a share, amounting to $1,852,000, on its preferred stock. The dividend, to be paid from capital, will be distributed on April 5 to stockholders of record on March 22.

APPROVED THE PROPOSED REDUCTION by Indiana & Michigan Electric Co. of its common capital stock liability by $2,000,000, without change in the number of shares outstanding and the creation of a capital surplus account of like amount.

APPROVED PROPOSAL by General Gas & Electric Corp. to pay out of capital or unearned surplus at $1.25 quarterly dividend on its $5 par preferred stock for the period ended March 15, 1943.

APPROVED PROPOSAL of Ogden Corp. to pay to stockholders of record March 8 a 50-cent dividend on its common stock. The payment will be made out of earned surplus to the extent of such surplus, and the balance out of capital surplus. The dividend payment will aggregate $1,701,846.

APPROVED ACQUISITION by Southwestern Public Service Co. of the electric and water properties located in Morton County, Kansas, owned by Kansas City Power & Light Co., a non-affiliated company, together with current and other assets appertaining to the properties. Southwestern will pay $62,500 in cash, subject to certain adjustments, for the properties.

DENIED Associated Electric Co.'s application for an exemption from the commission's bidding rule U-50 in order to sell its entire interest in Ohio-Midland Light & Power Co., its wholly owned subsidiary, to Joseph B. Wilson, a non-affiliate, for approximately $1,950,000. The commission held compliance with the rule is not inappropriate because Ohio-Midland's present securities are unsuitable for public distribution and said the advertisement for bids should contain a provision that the securities are not offered for the purpose of public distribution and that no bid will be accepted unless it contains assurance the securities will not be resold to the public.

Applications Filed

NIAGARA HUDSON POWER CORP. and subsidiary companies have filed their answer to the findings and opinion recently recommended by the public utility division of the Securities and Exchange Commission with respect to the corporate structure of Buffalo, Niagara & Eastern Power Corporation, a subsidiary holding company of Niagara Hudson Power. The findings and opinion, submitted to but not approved by the commission, recommended that Buffalo, Niagara & Eastern be recapitalized and voting rights extended to the holders of its $1.60 preferred stock.

The reply filed by the system companies requests that the findings be modified in certain respects and suggests that any order to be issued by the Securities and Exchange Commission may be satisfied by the presentation of a plan somewhat different from the plans specifically recommended by the public utility division.

Hearings Scheduled

MARCH 22. A hearing on the Engineers Public Service Co.'s proposal to acquire for cancellation $4,000,000 of its $5, $5.50 and $6 cumulative dividend convertible preferred stocks. The price for any of the stocks will not exceed $100 a share and accrued dividends.

APRIL 18. Oral arguments on the joint plan of reorganization of Midland United Co. and Midland Utilities Co. The postponement was granted to enable the companies to file briefs in answer to proposed findings of the SEC's public utility division.

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Insurance Group Urges SEC Action

Nine insurance companies have filed with the Securities and Exchange Commission a brief in support of the proposed findings and opinion of the public utilities division of the Securities and Exchange Commission, recommending that the Buffalo, Niagara & Eastern Power Corp. be required to reclassify three classes of stock into a single class.

The insurance companies, owners of 68,175 shares of the $5 cumulative first preferred stock of Buffalo, Niagara & Eastern, suggested various clarifying corrections in the language of the proposed findings and opinion. They asked also that they be permitted to enter the proceedings as a party or at least granted leave to be heard.

The public utilities division urged the SEC on February 19 to require Buffalo, Niagara & Eastern to reclassify its $1.60 preferred stock, Class A stock and common stock into a single class. It provided also for equitable voting rights for the $5 first preferred stock, but left that issue otherwise undisturbed.

"Such a revamping of the capitalization of Buffalo, Niagara & Eastern should clearly precede any ultimate decision as to the disposition of whatever interest the Niagara Hudson Power Corp. (parent of Buffalo, Niagara & Eastern) may hold after the revamping is complete," the insurance companies said.

Utility Reports

	Net Income 1943	1942
*Boston Edison	$5,394,148	$5,688,105
*California Oregon Power	†1,211,037	1,289,870
*Commonwealth Edison and subs.	22,392,999	22,108,102
*El Paso Electric and subs.	†617,710	513,870
*Engineers Public Service and subs.	5,595,123	4,062,908
*Gulf States Utilities	†2,209,100	1,703,170
*Houston Lighting & Power	2,831,233	2,841,568
*Iowa Southern Utilities	424,893	429,465
*Northwestern Electric	†619,322	648,744
*Pacific Power & Light	†1,227,856	931,201
*Public Serv. No. Illinois	3,669,954	3,237,447
*Savannah Elec. & Power	†412,506	327,367
*Texas Electric Service	†1,864,844	1,606,346
*Virginia Elec. & Power	†4,546,841	3,754,879
*Wisconsin Electric Power and subs.	4,206,857	4,051,764

*Twelve months ended December 31.
†Preliminary.

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Duke Power Co. Wins Tax Suit in New Jersey

New Jersey's Court of Errors and Appeals has ruled that Hillsborough Township, in Somerset County, had no right to tax the intangible personal property of the Duke Power Co. for the 1939 taxing year.

In deciding against the township's attempt to tax the utility company the Errors Court relied on an opinion of the State Supreme Court, which a year ago voided an assessment of $11,604,815 against the utility's stocks, bonds and other securities.

The recent opinion brought to a close the township's campaign to collect an estimated $367,000 in taxes on the securities. The assessment was set aside by the State Supreme Court on the ground the company was exempt.

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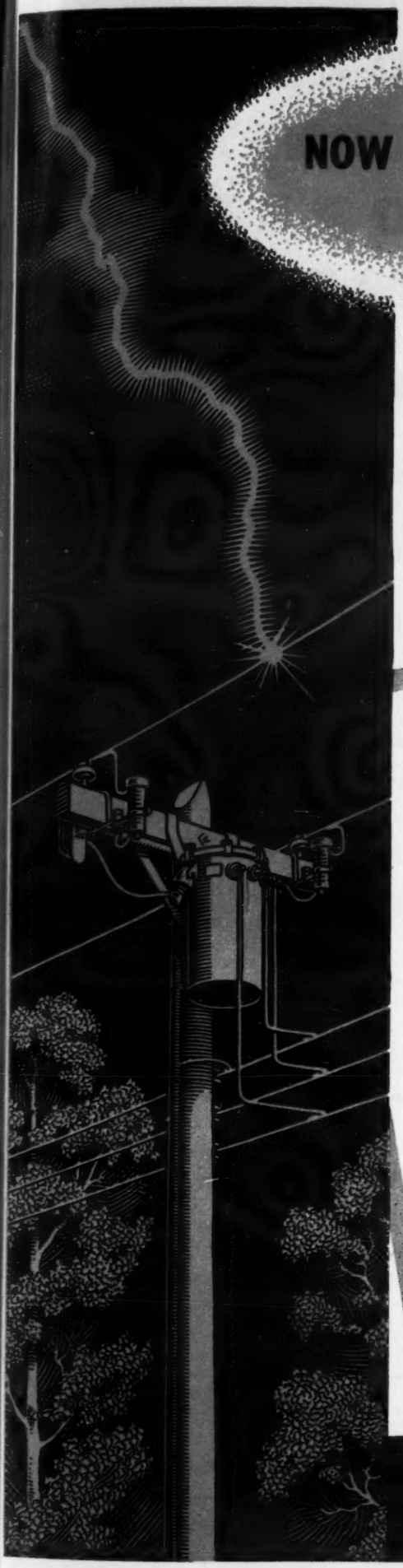
Stockholders Vote Plan of U.G.I. on Divestment

Stockholders of United Gas Improvement Co. approved overwhelmingly at a special meeting the company's plan to distribute to them its holdings of 1,162,600 shares of common stock of Delaware Power & Light Co. in divestment of its control of that company.

At the same time the stockholders approved the company's proposal to reduce the stated capital applicable to its common stock in the amount of $16,463,014, representing the aggregate book costs of Delaware Power & Light Co. common stock to be distributed to U.G.I. capital stockholders in the ratio of one share for each twenty shares of U.G.I. capital stock held.



NOW Reliable Lightning Protection Is More Important Than Ever

1. It preserves investments in costly or unreplaceable electric equipment.
2. It protects new or old apparatus from damage and keeps it in service.
3. It reduces repair or replacement demands involving vital materials.
4. It prevents interruptions of indispensable power service to consumers.

ON DISTRIBUTION LINES

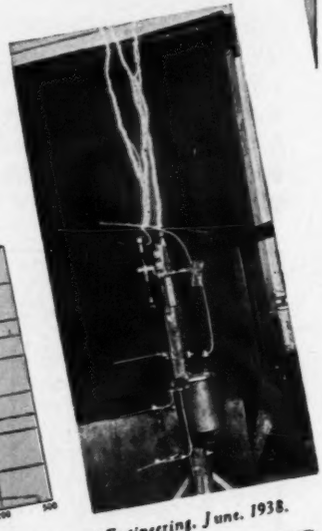
You can be sure of adequate protection with G-E pellet arresters

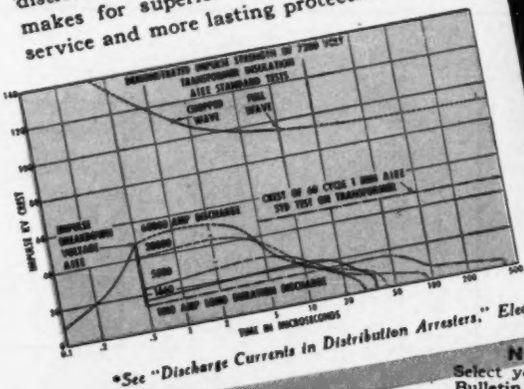
BECAUSE

1. **Pellet arresters limit stresses to less than half the impulse strength of the distribution transformer, even with severe lightning discharges.** (In the graph below, the impulse volt-time oscillograms of the 9-kv pellet arrester are compared with the volt-time impulse test strength of a 7200-volt distribution transformer. No other distribution protective device assures such a large margin of protection.)

2. **Pellet arresters have large discharge capacity.** Pellet arresters withstand severe lightning strokes. They have discharge capacity in excess of the highest lightning discharge currents measured on distribution circuits.*

3. **Pellet arresters have valve action.** The best arresters ever made—those used for protection of the most costly power apparatus—have always been of the valve type. In distribution arresters, too, valve action makes for superior continuity of power service and more lasting protection.





*See "Discharge Currents in Distribution Arresters," *Electrical Engineering*, June, 1938.

NO NEED TO GAMBLE
Select your G-E pellet arrester from Bulletin GEA-2975. General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

HOW DESIGN... CONSTRUCT OPERATE MAINTAIN

Soil Change Reduces Cable Temperature

Experience with the overheating of non-lead sheath cable buried in soil of low thermal conductivity on the system of the Louisville Gas & Electric Company has brought about a change in the method of burying cables of this type which takes full advantage of both moisture and soil for carrying heat away from underground cables. Findings are particularly notable at a time when heavy war loads are focusing attention on methods of overcoming thermal bottlenecks in underground cables.

The investigation of soil conductivity arose when it was found that a 600-ft. run of six single-conductor, 1,500,000-cir.mil, 13.8-kv. neoprene-sheath cables insulated with oil-base, corona-resistant, rubber-like compound were operating—two per phase—at a temperature of approximately 60 deg. C under a loading of 1,300 amp. per phase. These cables had been buried, as shown, in fine sand to a depth of about 3 ft. in a trench 2 ft. wide and 4 ft. deep. The trench is in filled ground that does not hold moisture in dry weather.

Tests of the thermal conductivity of sand, sandy clay and clay were undertaken when it became evident that heat was not being carried away from the cable at a high enough rate. These tests confirmed the suspicion that sand, even when tightly packed, had a low conductivity rate and that clay was to be preferred.

The cables were accordingly relaid in a single tier 2 ft. below grade in a wide but shallow ditch filled with yellow clay. The manner of laying the cable is shown.

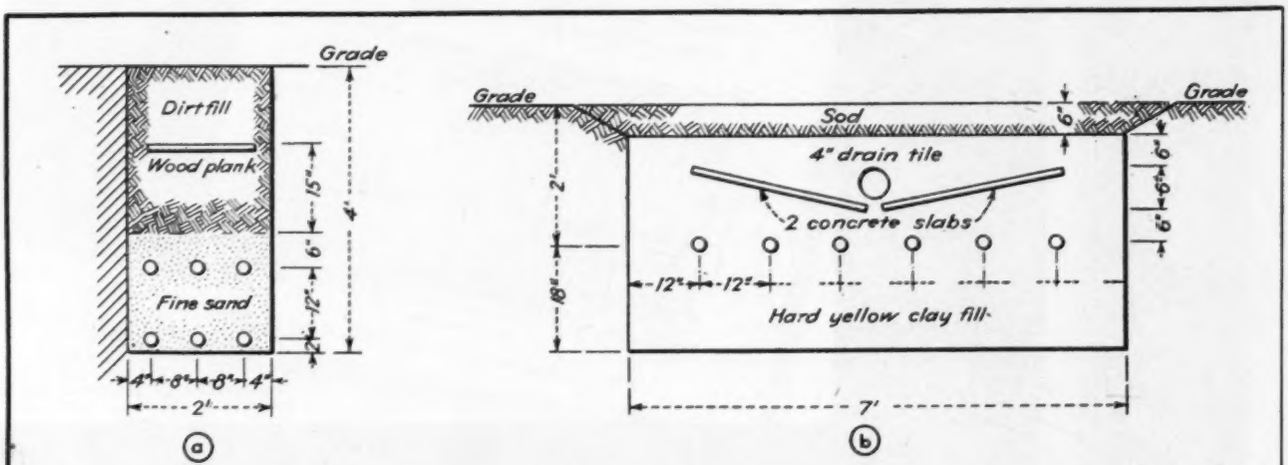
In addition to changing the type of soil around the cables, steps were taken to keep the soil moist and thus increase thermal conductivity. Two 2-in. thick concrete slabs in the form of a shallow V were buried above the cables to catch surface moisture and direct it into the soil around the cables. In addition, a 4-in. drain tile was centered above the shallow V formed by the slabs and during dry periods water in small amounts circulated through it and allowed to seep from joints into the surrounding soil.

As a result of these changes cable-operating temperature has been reduced 10 to 15 deg. below the value experienced when the cables were buried in sand, and when dry soil conditions existed.

•

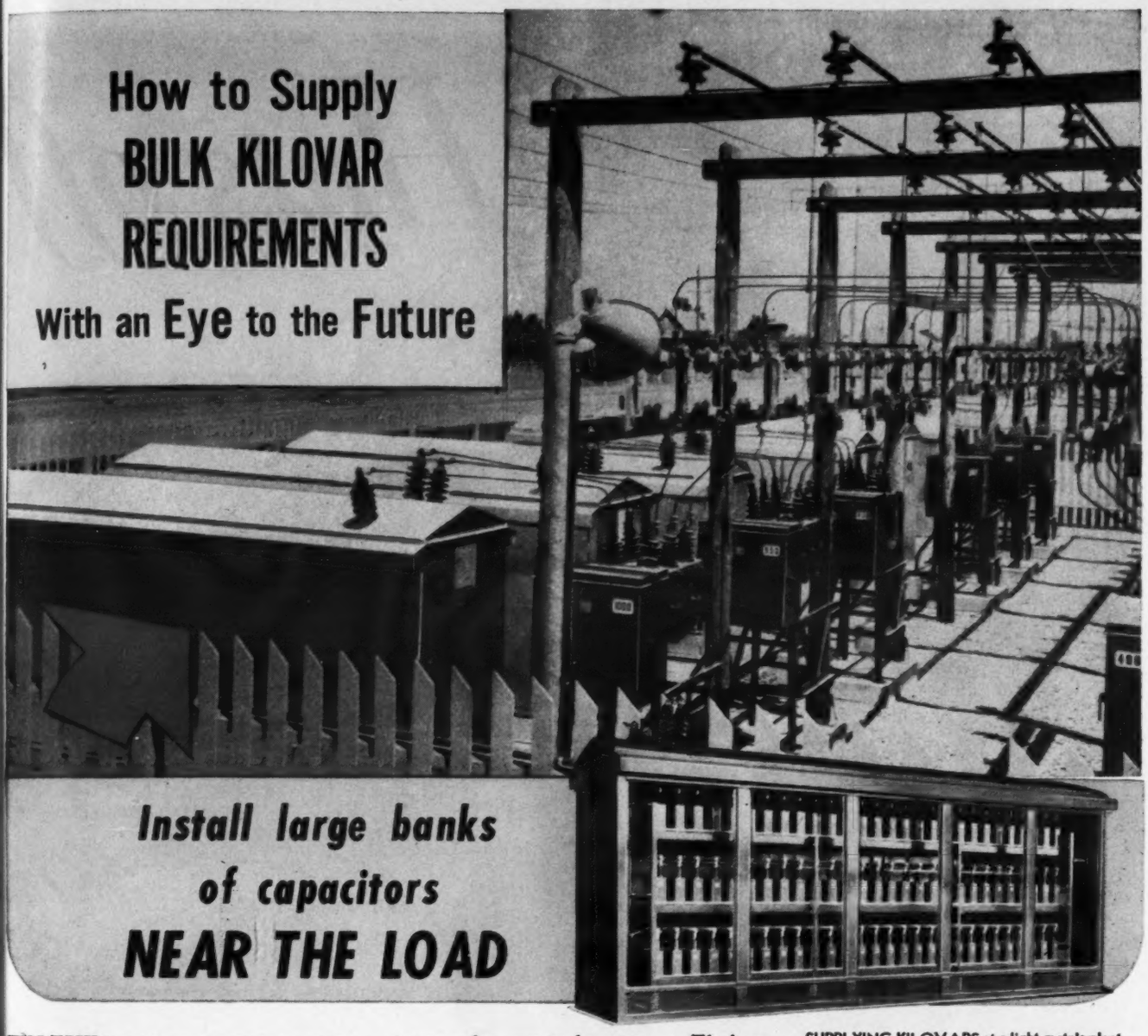
Board Keeps Record of Transformers

Visible record is kept of all transformers in the Salt Lake Division of the Utah Power & Light Company by means of the board shown in the accompanying illustration, which is 3



REDUCTION OF 10-15 deg. in cable operating temperature accompanied the change in method of burying non-leaded cables shown: original installation (a), improved installation (b)

How to Supply BULK KILOVAR REQUIREMENTS With an Eye to the Future



Install large banks of capacitors NEAR THE LOAD

SUPPLYING KILOVARS at a light-metals plant in the West—Pyranol capacitor equipments totaling 25,200 kva. Inset is a typical 2520-kva equipment, opened at the side to show 15-kva capacitor units and fuses.

IN THE past two years a quarter of a million kva of large banks of Pyranol* capacitors have been installed *near the load* to meet wartime demands for large blocks of reactive kva. Why *near the load?* Because it has been found that, when the reactive requirement is supplied by distant generators, it is not uncommon for approximately one-third of the kilovars to be consumed in transit by the I^2X required by the conductors and transformers—not to mention the I^2R losses caused at the same time.

Capacitors are an ideal reactive source for several reasons. Their ready availability means that they can be obtained and installed in a matter of weeks. Their installed cost is well under $10 per kva. Relatively little critical material is needed in their manufacture as well as in their installation, compared with that required for additional circuit facilities.

A fact that adds immeasurably to the useful life of your investment is that, if future changes in system or load eliminate the need for the large bank, the capacitor units can be used later in smaller groups. G-E rack-type Pyranol capacitor equipments (for either outdoor or indoor installation) are ideal for this purpose.

Ask your G-E representative to estimate the benefits of large Pyranol capacitor banks on your system, or write for GEA-2746B. *General Electric, Schenectady, N.Y.*

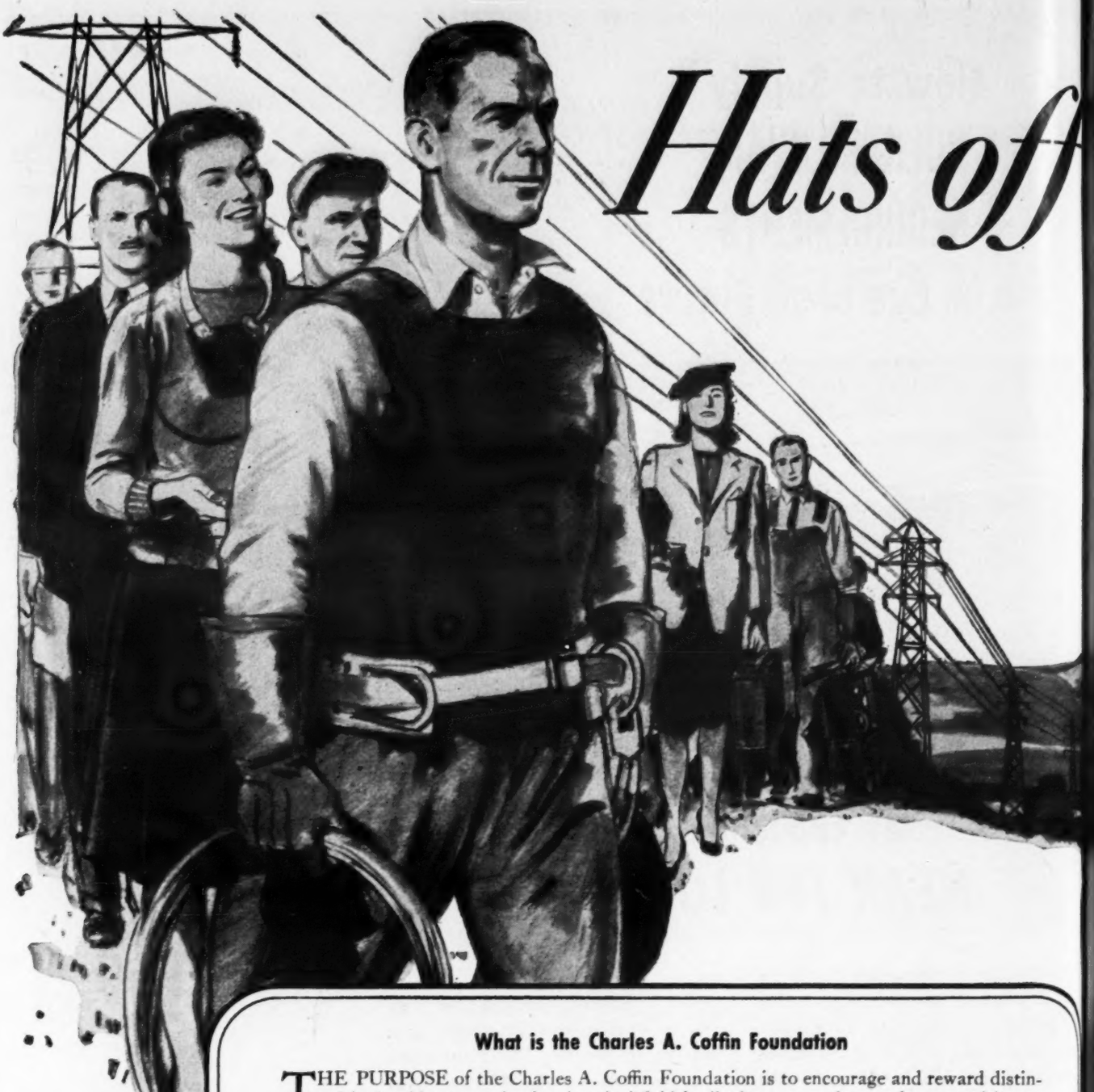
*Reg. U. S. Pat. Off.

Every week 192,000 G-E employees purchase more than a million dollars' worth of WAR BONDS

GENERAL ELECTRIC

407-71-6700

PYRANOL CAPACITORS



Hats off

What is the Charles A. Coffin Foundation

THE PURPOSE of the Charles A. Coffin Foundation is to encourage and reward distinguished achievement in the electrical field by "prizes to employees; by recognition to lighting, power, and railway companies for improvement in service to the public; by fellowships to deserving graduate students; and by the grant of funds for research work at technical schools and colleges."

Establishment of the awards was announced twenty-two years ago in a statement issued by President Swope and dated December 2, 1922:

"On May 16, 1922, Charles A. Coffin in his 78th year retired from the active leadership of the General Electric Company. Mr. Coffin has been identified with the development of the electrical industry since 1882. He was the founder and creator of the General Electric Company, of which he has been the inspiration and leader for thirty years.

"As an expression of appreciation of Mr. Coffin's great work not only for the General Electric Company but also for the entire electrical industry and with the desire to make this appreciation enduring and constructive as Mr. Coffin's life and work have been, the Board of Directors of the General Electric Company created on his retirement and now desires to announce the 'Charles A. Coffin Foundation.'"

GERARD SWOPE, *President*

Invest in Your Country's Future—BUY WAR BONDS

This advertisement is appearing in more than 200 daily newspapers during the week of March 13, and in 1490 weekly newspapers during the month.

to the People who Produce your Electric Light and Power

The Charles A. Coffin Foundation
confers a special citation for
distinguished wartime achievement
on the
ELECTRIC LIGHT AND POWER INDUSTRY

"Faced with unprecedented demands, the Electric Light and Power industry has met every war-production requirement without delay and without impairment of its peacetime services to the public. This achievement merits the appreciation not only of American industry but of the entire nation."

—FROM THE CITATION

THIS CITATION is richly merited — for here is a branch of industry that has done a remarkable war job that has not been generally recognized.

If electric power should fail, or if it be too little or too late, the disastrous effects would startle all America. Vital machines would be motionless. Millions of homes would be cold—and an eerie blackout would descend over the land.

But, electricity has not failed. Rather, in 1943 twice as much power was produced as in the year before the war—with the minimum of new facilities—and despite large losses of skilled employees to the Armed Services.

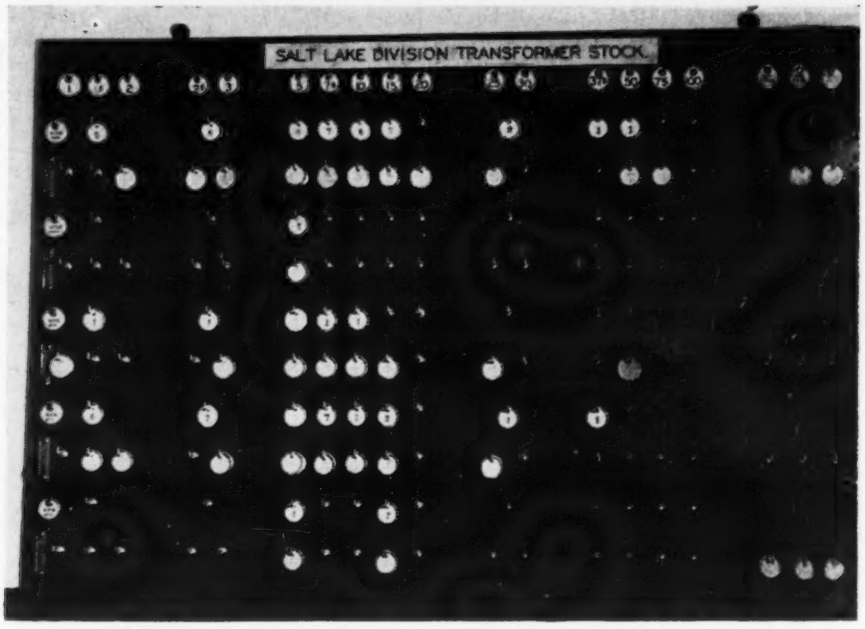
In the words of J. A. Krug, Director, Office of War Utilities of W.P.B., "Power men—public and private—should be proud of the job that has been done in providing power supply. Power has never been too little or too late."

We of General Electric, who have built a large part of the electric equipment which generates, distributes, and uses the electric power of America, take pride in the way this equipment is standing up under the strain of "forced draft" wartime operation.

Many of the men and women responsible for this remarkable record are your neighbors—the manager or meter reader who lives across the street, the girl in the accounting department who is in your bridge club, the lineman with whom you bowled last night. A word of appreciation from you to them will lend added significance to this well deserved citation. *General Electric Company, Schenectady, New York.*

GENERAL ELECTRIC

952-808-211



TRANSFORMER stock record board

ft. wide by 2 ft. high and made of plywood. The tags used are 1 in. in diameter and are hung on ¾-in. screw hooks. Operation of the visual record which is now being adopted by the other divisions, is described by the company as follows:

The row across the top represents the various sizes of transformers. The second row of tags shows the WPB minimum allowed the division. The third row shows the actual number of transformers of each capacity in stock, the size and company number being written in pencil on each tag and hung on the screw hook under the size of transformers shown on the top row.

On the extreme left side is shown the different voltage transformers, *viz.*, 2,300-volt, 4,000-5,000-6,900 and 11,000-volt. The WPB minimum is shown on the tags with the stamped figures for each voltage and the number of transformers in stock is hung under the sizes of the rows paralleling the voltage shown with the WPB minimum directly above.

For transformers which are stored in the outlying districts a yellow tag is used which carries the transformer data plus the district where stored. All transformers stored in Salt Lake are shown on a white tag.

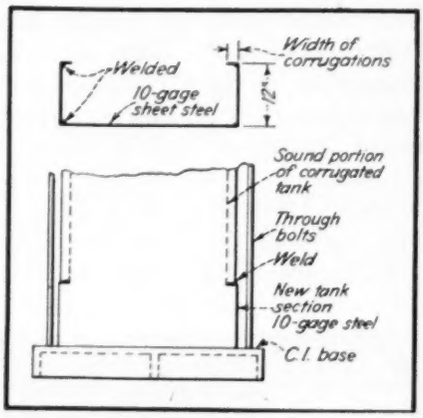
On the right of the board are places left for transformers of odd sizes and odd voltages, transformers earmarked for WPB-approved jobs and damaged transformers. Green tags are used for damaged transformers. The superintendent, foremen or estimators can tell instantly how many and the kind of transformers that are on hand and where they are by a glance at the board.

The company has found the board well worthwhile as an emergency record and believes it will be a permanent fixture after the war, in which case the tag marked WPB minimum can be changed to read: "Normal Working Stock," with actual inventories shown on the tag below.

•

How to Repair Rusted Transformer Tank

Accompanying sketches illustrate a method used by Minnesota Power & Light Co., Duluth, to repair the corrugated sheet-iron tank of a 250 kva., 22,000/220-440 volt transformer which had rusted thin near the base and was leaking oil.



NEW BOTTOM SECTION replaces rusted portion of corrugated sheet iron transformer tank

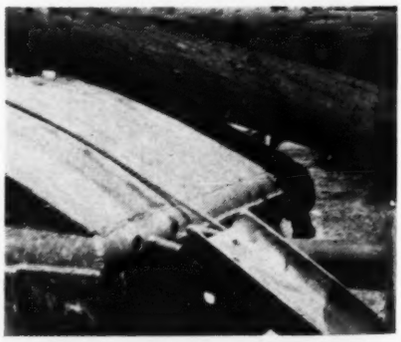
Bottom 12-in. section of the corrugated sheet iron tank was cut off. To take its place a steel box—oblong in section to conform to the shape of the tank—was made up from 10-gage sheet steel in the company's shops. This box, 12 in. deep, was closed at the bottom and open at the top except for a "shelf" the width of the tank corrugations, which projected in from its top edge. The sound upper portion of the corrugated tank was welded to this shelf or "lip." Tank and new bottom section were placed atop the original cast iron base. Through bolts from the transformer cover to the original cast iron base were installed to hold the tank in place.

As the bottom of the transformer contains the coolest oil, the slight reduction in radiating surface was not important and no reduction in rating was necessary.

•

Detachable Ramp Speeds Pole Loading

Only two men are required to load pole trailers using this trailer "ramp" designed by W. Hostetler, line foreman, and his crew of the Central Power & Light Company, Victoria.



CLOSE-UP VIEW of channel-iron ramp

POLE is snaked up the ramp

Complete Drive in Four Units

(Note how easily the components fit into this compact jig saw.)

and now

Thy-mo-trol drive in fractional-hp sizes

The ideal drive for:

- Jig saws
- Lathes
- Drill presses
- Pumps
- Grinders
- Conveyors

and many other applications

Sizes down to 1/8 hp—smaller if needed.
And you get all these THY-MO-TROL advantages:

Constant speed—No Load to Full Load

No matter how much the load on your machine changes (within the adjustable preset torque limit), Thy-mo-trol drive will hold the speed very close to the point at which you set it.

Stepless Speed Control

You get complete adjustment of motor speed without steps—just by turning the speed-adjusting dial. And you can get a speed range of 20:1—or greater.

D-c Performance from A-c Power

You obtain all the inherent advantages of the d-c motor—and on a-c power.

Single Control Station

Starting, accelerating, control of speed, and stopping (by dynamic braking) are all controlled from a single, compact station.

How to Buy Thy-mo-trol

Just give our local office complete information about your requirements—nature of the load, speed range, horsepower, etc. Our engineers will select just the right electronic panel, motor, transformer and control station, the Thy-mo-trol drive components that will give you exactly the operating characteristics you want.

Standard drives can be obtained in ratings from 1/8 to 15 hp. If you need a higher or lower rating, let us know. Also, ask for Bulletin GEA-4025. *General Electric Co., Schenectady, N. Y.*

THY-MO-TROL DRIVE

Every week 192,000 G-E employees purchase more than a million dollars' worth of War Bonds

GENERAL ELECTRIC

668-13-8930

GENERAL ELECTRIC RESEARCH

Behind the scenes in G-E's Lamp Development Laboratory. Here engineers perform two of the many tests given General Electric's new lamp for instant-starting. At the left a cathode ray oscillograph test is in process, while the other engineer takes a reading on an automatic timing device that turns the lamp off and on more than 1400 times a day—to insure a high degree of dependability.

GENERAL ELECTRIC

DEVELOPS FLUORESCENT LAMP for INSTANT-STARTING!

New General Electric 40-watt Fluorescent Lamp Starts Instantly and Positively

Here is fluorescent lighting—at the flick of a switch! A fluorescent lamp that starts as instantaneously as an incandescent lamp!

General Electric soon will make available a 40-watt white G-E Mazda fluorescent lamp for operation with instant-starting ballasts. Shipments in limited quantities will start May 1st. New General Electric instant-starting ballasts will be made available at the same time by G-E's Transformer Section in Ft. Wayne.

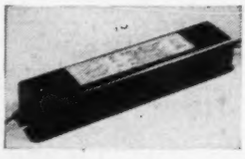
Instant-starting can be obtained with regular fluorescent lamps when used with an instant-starting ballast, but only at the cost of a substantial reduction in lamp life. The new 40-watt G-E fluorescent lamp operates on instant-starting ballasts *without sacrifice of rated lamp life.* It will sell for the same price as regular 40-watt G-E Mazda fluorescent lamps.

The new lamp, operating with a high voltage instant-starting ballast, eliminates the need for conventional starters. However, under abnormal operating conditions, such as high humidity, special provision may be needed to assure starting.

Another Example of G-E Leadership in Lighting

The development of the new fluorescent lamp for instant-starting is just one more example of the never-ending lighting progress led by General Electric lamp research. Through this research is assured the uniform quality and dependability that are characteristic of the complete line of General Electric Mazda lamps.

G-E High Voltage Ballast for Instant-Starting



Latest development in the G-E Specialty Transformer laboratories at Fort Wayne is the new type ballast for use with instant-starting fluorescent lamps. Available in limited quantities about May 1st in four voltages with end out or base out leads. Rated life of the new fluorescent lamps when used with these ballasts is the same as that of regular G-E Mazda F lamps using the conventional switch and starter.

Hear the General Electric radio programs: "The G-E All-Girl Orchestra," Sunday 10 p. m. EWT, NBC; "The World Today" news, every weekday 6:45 p. m. EWT, CBS.

THE BEST INVESTMENT IN THE WORLD IS IN THIS COUNTRY'S FUTURE —BUY WAR BONDS

"TO MAKE LAMPS STAY BRIGHTER LONGER"
The Creed of G-E RESEARCH

G-E MAZDA LAMPS

Texas. One man handles the winch and the other fastens the line to the poles. Both bar the poles over on the load as they are snaked up the removable channel-iron ramp onto the body of the trailer. Company Safety Director D. E. Woods points out that the presence of the man on the trailer while poles are being loaded is a violation of safe practice.

•

Rugged Design Marks Subway Luminaire

Rugged features of the specially designed fluorescent luminaire developed and used throughout Chicago's State Street subway* suggest its applicability for installations where uncommonly rigorous conditions exist and for which conventional fixtures are not fitted.

Exacting requirements of subway conditions imposed several strict limitations on the Chicago subway fixture design. These included dependability under all probable weather conditions, high efficiency distribution adapted to low ceilings, proper diffusion and good appearance, a glass inclosure with gasketed joints and continuous support for dust tightness and protection against cold air currents, sturdiness of fixture and hinged frame for ease of access and maintenance, close tolerances to allow interchange of parts, selection of materials to conform to war restrictions and low cost, to justify purchase of several thousand units.

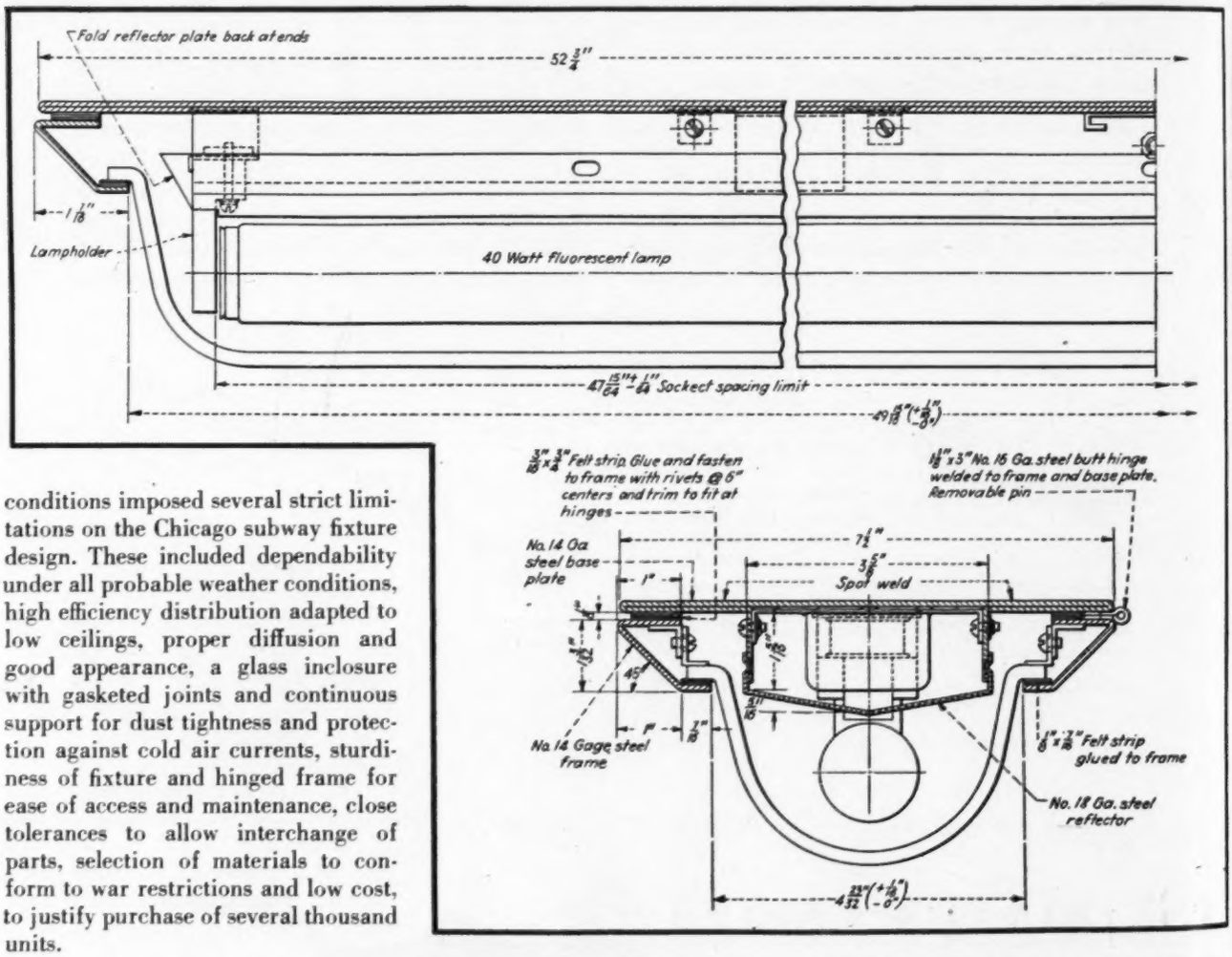
Objectives set for the inclosing shields were that they be of medium and high diffusion glass, in one piece, with integral ends and a continuous support flange to set between gaskets bearing on the fixture base and frame. The fixture was to be suitable for housing a 48-in., 40-watt lamp.

Subway engineers, working in cooperation with fixture manufacturers, developed the design which is illustrated. This fixture structure, of sheet steel with baked enamel finish, includes a one-piece base with sides overlapped, spot-welded and formed with parallel legs—in order to give structural strength and to support the reflector. The one-piece reflector has converging slightly inclined reflecting surfaces. Its edges are turned to spring over the base plate stiffening legs. These two parts form in effect a box girder which houses ballast, starters, and fixture wiring. The rectangular frame, which has mitered welded corners, is a shallow truncated pyramid. Hinges are welded to the base plate and frame. A concealed spring latch is on the opposite side and is operated through a key slot.

Depth of the unit is only 4 in. It was thus particularly adapted to low ceilings, since it gives a wider distribution of light than is normally obtained with incandescent filament lamps.

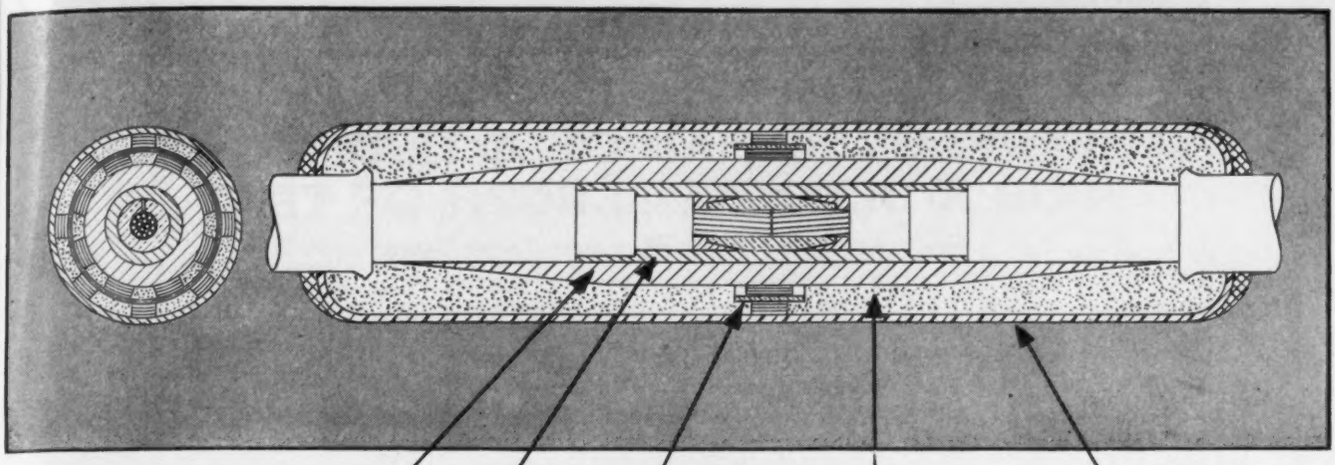
Perhaps the most serious problem encountered with the Chicago design was that commonly used fluorescent lamp starters were not dependable at near freezing temperatures. This was confirmed by tests which showed the superiority of the thermal type starter at low temperatures, particularly the mogul-size, four-contact thermal starter, which is dependable down to zero deg. F. Ballasts used were the single-lamp high power factor type which are mounted in contact with the metal base for dispersal of heat.

In all there are 2,850 of these fixtures used on the State Street subway.


Fold reflector plate back at ends
52 3/4"
1 1/8"
Lampholder
40 Watt fluorescent lamp
47 15/24 +1/4 -1/4" Sockect spacing limit
49 5/8" (+1/8" -3/8")
3/16"x3/4" Felt strip. Glue and fasten to frame with rivets @ 6" centers and trim to fit at hinges
1 1/4"x3" No. 16 Ga. steel butt hinge welded to frame and base plate. Removable pin
No. 14 Ga steel base plate
7 1/2"
3 5/8"
Spot weld
1"
45°
1"
1/8"
No. 14 Gage steel frame
1/8" x 3/16" Felt strip glued to frame
No. 18 Ga. steel reflector
43 11/32" (+1/16" -0")

FIXTURE DESIGN developed for Chicago subway is arranged to withstand uncommonly rigorous service conditions

*See also "Fluorescent in Chicago's Subway," "Electrical World," Dec. 11, 1943.



G-E FILLING COMPOUND 227

During four decades G-E Compound 227 has been recognized and used as a standard insulating filler for cable splicing and termination purposes. Its characteristics are well known — ease and smoothness of flow (65–75 deg. flow point and 165 deg. C pour point); high dielectric strength and moisture resistance; retention of semi-plastic consistency where poured; easy melt-out without injury to molded compound. It is also standard filler for cable end bells, coupler sockets, pot heads and similar applications. It is one in a complete line of G-E Insulating Materials. For catalog, consult your local G-E distributor or write to Section M341-9, Resin and Insulation Materials Division, General Electric Company, Schenectady, New York.

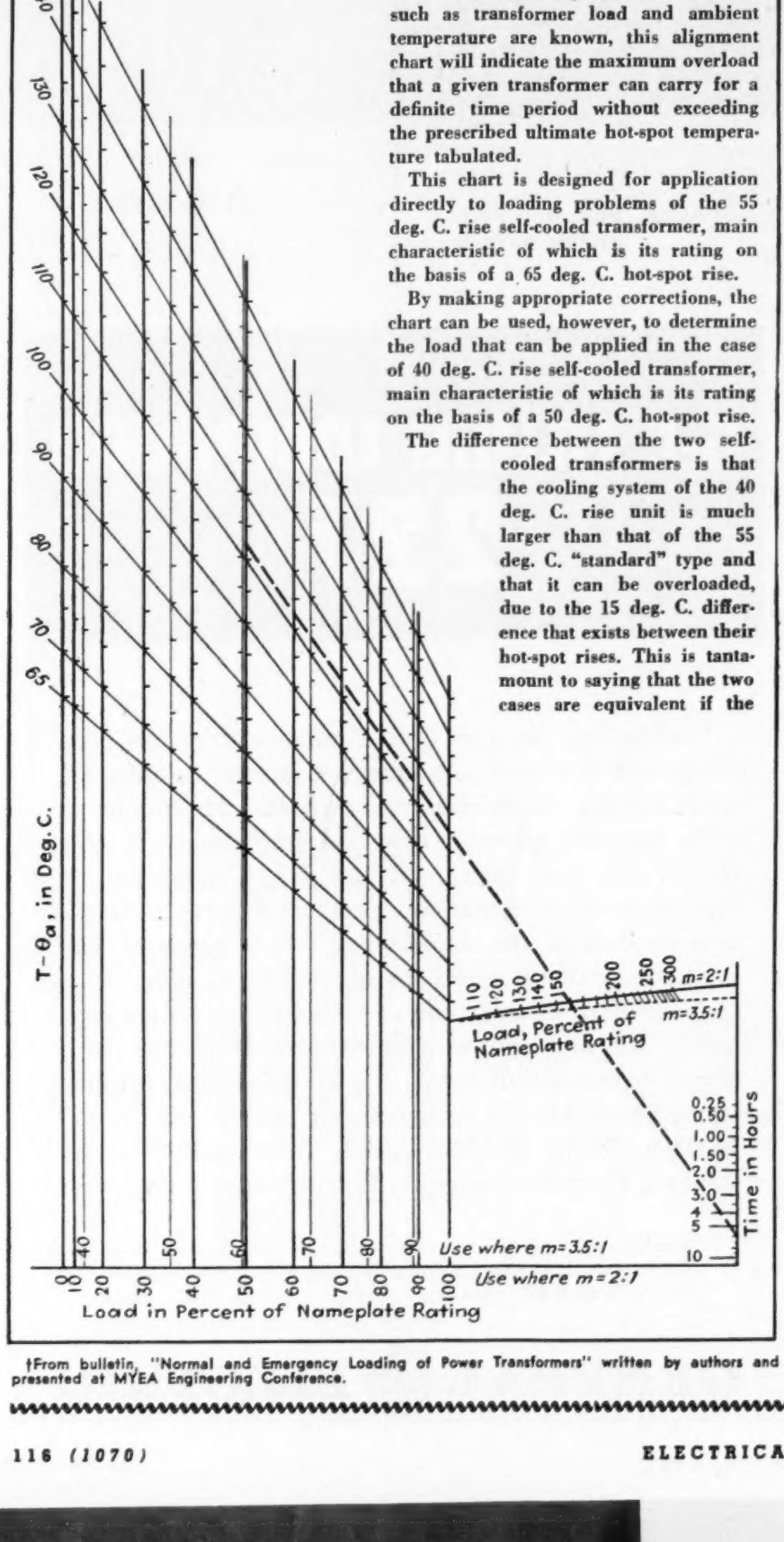
Hear the General Electric radio programs: "THE G-E ALL GIRL ORCHESTRA" Sunday 10 P.M. EWT. NBC. "THE WORLD TODAY" news every weekday 6:45 P.M. EWT. CBS.

GENERAL ELECTRIC

CHART FOR DETERMINING

MAXIMUM OVERLOAD OF A TRANSFORMER FOR A DEFINITE LENGTH OF TIME

By H. B. KEATH and W. L. J. F. GODIN†, Wagner Electric Corporation, St. Louis



When conditions previous to overload such as transformer load and ambient temperature are known, this alignment chart will indicate the maximum overload that a given transformer can carry for a definite time period without exceeding the prescribed ultimate hot-spot temperature tabulated.

This chart is designed for application directly to loading problems of the 55 deg. C. rise self-cooled transformer, main characteristic of which is its rating on the basis of a 65 deg. C. hot-spot rise.

By making appropriate corrections, the chart can be used, however, to determine the load that can be applied in the case of 40 deg. C. rise self-cooled transformer, main characteristic of which is its rating on the basis of a 50 deg. C. hot-spot rise.

The difference between the two self-cooled transformers is that the cooling system of the 40 deg. C. rise unit is much larger than that of the 55 deg. C. "standard" type and that it can be overloaded, due to the 15 deg. C. difference that exists between their hot-spot rises. This is tantamount to saying that the two cases are equivalent if the ambient in the case of the 40 deg. C. rise unit is made 15 deg. C. lower. Thus the chart may be used to find the maximum allowable overload of a 40 deg. C. rise self-cooled transformer by applying for it a new corrected ambient that is 15 deg. C. lower than actual.

In the development of the chart the following basic assumptions and symbols were used:

Average time constant.....3.33 hr.
Ratio of losses, *m*, (copper to core at F.L.).....2:1*
Also at F. L.....3½:1**
Oil rise.....45-40-30
Normal Hot-Spot Rise.....30-25-20
θ_a = Ambient temperature
T = Maximum allowable hot-spot copper temperature

* Generally associated with self-cooled, combination self-cooled forced air cooled and water-cooled transformers.

** Generally associated with 60-cycle transformers having a high ratio of losses due to particular requirements calling for low core loss-high inherent impedance 60-cycle transformers or standard 25-cycle transformers.

Time hours	Temp., deg. C. H. B. K. (author)	A. I. E. E. Interim report
0.25	150.4	
0.50	143.6	
0.75	139.7	
1.00	137.0	137.0
1.25	135.0	
1.50	133.1	
1.75	131.9	
2.0	130.7	130.0
2.5	128.8	
3.0	127.2	
3.5	125.9	
4.0	124.8	125.0
5.0	122.9	
6.0	121.4	
7.0	120.1	
8.0	191.1	120.0
9.0	118.1	
10.0	117.3	
24.0	110.6	110.0

Self-Cooled Transformers — Gradients and Temperatures

Self-cooled rating	55 deg. C rise 65 deg. C hot-spot rise	*40 deg. C rise 50 deg. C hot-spot rise
Hot spot above top oil	20 deg. C	20 deg. C
Ambient	45 deg. C	30 deg. C
Hot spot temperature	30 deg. C	30 deg. C
	—	—
	95 deg. C	80 deg. C

Note: * A 40 deg. C rise transformer may be overloaded 20 percent of its name plate rating without exceeding a 95 deg. C hot-spot temperature.

EXAMPLE FOR USE OF CHART

Problem: Transformer is operating at 40 percent load. Ambient temperature = 10 deg. C. How much load can be carried for six hours? m = 2:1

Solution: Subtract ambient temperature from ultimate hot-spot temperature corresponding to 6 hr. as shown on table. Connect this point (121.4—10 = 111.4) on 40 percent load scale to point corresponding to 6 hr. on time scale. Where this straight line intersects the overload scale, read the allowable overload.

Answer: This gives, for this problem, 160 percent load for 6 hr. with 10 deg. C. ambient temperature following 40 percent continuous load.

†From bulletin, "Normal and Emergency Loading of Power Transformers" written by authors and presented at MYEA Engineering Conference.

PHILCO *Floté* Batteries

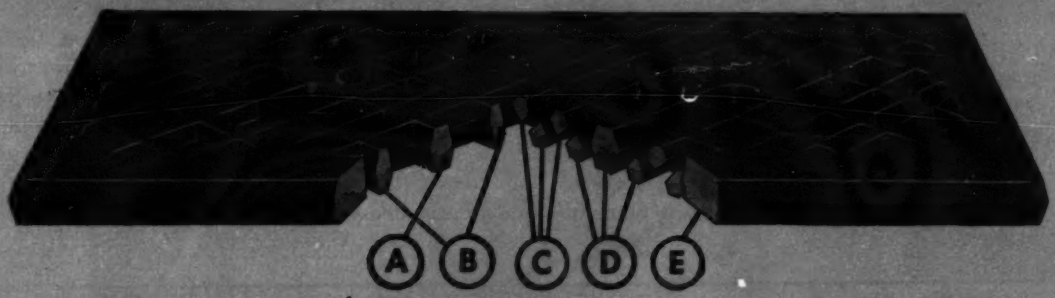
FOR LONGER LIFE
HIGH ELECTRICAL EFFICIENCY

THE long service life and high electrical efficiency of Philco Floté Batteries is a direct result of the Philco Floté grid design and the special metal in which it is cast. Because a minimum of metal is exposed on the plate surface, peroxidation is materially retarded. The grid design and structure (as shown in the cutaway section below) not only provides exceptional strength, but produces superior electrical efficiency.

Philco Floté grids are cast in a special metal which reduces by as much as 40% the amount of current necessary to maintain the charge in full float operation!

For complete information and engineering specifications, write for the latest Philco Floté Battery catalog.

Philco Corporation, Storage Battery Division
Trenton 7, New Jersey



END VIEW OF PHILCO FLOTÉ POSITIVE GRID SHOWING CROSS SECTION OF CONSTRUCTION

A—MASTER EFFICIENCY CONDUCTOR "A". Taper provides extra surface for lower resistance and exposes a minimum of metal on the surface of the plate.

B—MASTER EFFICIENCY CONDUCTOR "B". An equalizer on both charge and discharge. Affords superior locking of active material. Through-members run in direction of lug.

C—SMALLER FLOTÉ GRID MEMBERS. Run only from left to right, furnishing perfect grid balance and adding to overall electrical efficiency.

D—TRIPLE DIAGONAL CONDUCTORS. Close combination of two light members and a heavy through-member improves conductivity and adds to service life.

E—EXTRA HEAVY GRID FRAME. Surrounds the internal Floté members for maximum structural strength and durability.

Specify PHILCO *Storage Batteries*

How to Test Insulating Materials*

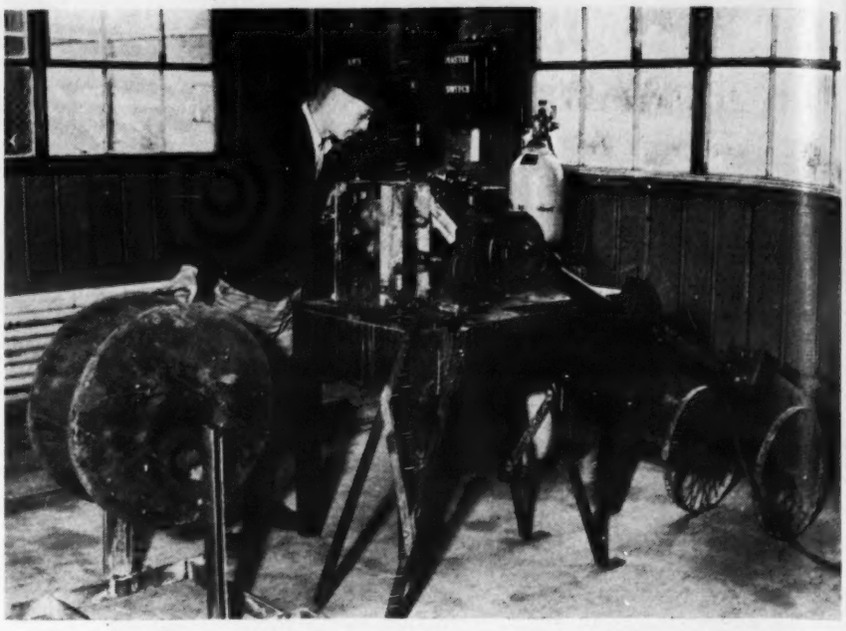
8—Influence of Frequency

By A. E. PARKINSON
Continental-Diamond Fibre Co., Newark, Del.

Power factor and dielectric constant measurements are usually made at alternating current frequencies of 60, 1,000 or 1,000,000 cycles per second, the particular frequency chosen being dependent upon the particular application involved. In practice an insulating material may be required to perform under conditions in which a wide range of frequency is met. It is therefore not merely of academic interest to know the effect of current frequency on the power factor.

Examples of how the power factor and the dielectric constant of an insulating material varies with frequency are shown in accompanying graphs. The curves (Fig. 1) for an aniline-formaldehyde resin plastic (Dilectene) covers a very wide range of frequency, from 100 cycles to 100 megacycles, while those (Fig. 2) for a laminated phenolic plastic (Dilecto) cover only high frequency from 1 to 100 megacycles. The latter are composite curves for grades XX, XXXP and CE sheet material of $\frac{1}{16}$-in. thickness. It is interesting to note that though the dielectric constant for each material decreases as the frequency increases, the power factor of the Dilecto increases, while over the same frequency range that of Dilectene decreases. This may be explained by the fact that the latter insulating material is a homogeneous resinous material, while the former contains a non-resinous filler.

*This series began in "Electrical World," Dec. 11, 1943 issue.



SHORTAGE of copper ribbon for transmission conductor was overcome with this device that rolls ribbon from reclaimed wire; an acetylene flame heats the wire as it enters the rolls

Copper Tape Rolled From Scrap Wire

By GEORGE A. DELNAY
Consumers Power Company, Jackson, Mich.

When you can't buy it, you either make it yourself or go without. This choice faced the Consumers Power Company, Jackson, Mich., not long ago with respect to the familiar 0.3 x 0.05-in. copper ribbon used to protect transmission conductors at the point of support. In this case ribbon of satisfactory dimensions was rolled from annealed No. 6 AWG wire, using the home-made power roller as shown in the illustration above.

The company warehouse foreman made this device from scrap material. Two pieces of 4-in. round steel were made up as rollers with attached gears salvaged from scrap automotive equipment. A gear box from a switch tank lifting device was included and all mounted in a steel frame. The device is driven by a Toledo power drive normally used in the warehouse to operate pipe-threading devices.

Reclaimed, annealed No. 6 AWG wire is used to make the ribbon. As the wire is rolled, an acetylene flame is applied to it at the point where it passes between the rolls. This operation may not have been the most efficient way of obtaining the ribbon, but at the time it was the only way open for supplying necessary material to the job.

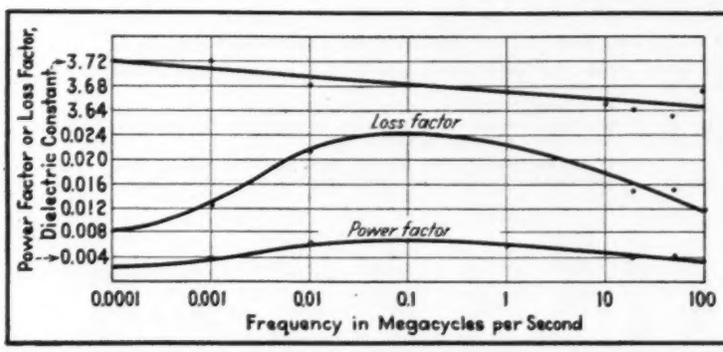


FIG. 1—Variations with frequency in power factor, loss factor and dielectric constant of Dilectene

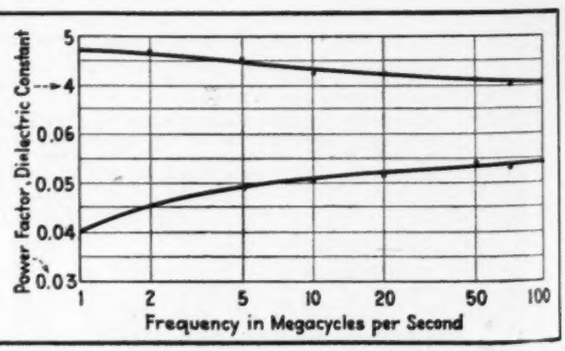
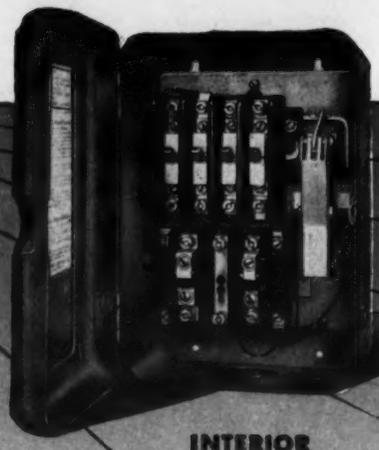


FIG. 2—Variations with frequency in power factor and dielectric constant of Dilecto

outward sign

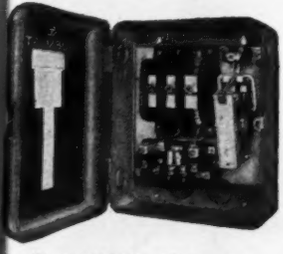


INTERIOR MAGNETIC STARTERS

OF INWARD BETTERMENT . . . IN MOTOR STARTERS

Type "TT" Manual Starter for small motors (1 hp max.)

Type "TM" Manual Starters "TM-2", 2 hp., "TM-7-½", 7-½ hp.



Type "CM" Magnetic Starters also Contactors Motor reversing

Point by Point . . .

WIDE, COORDINATED RANGE of stock units . . . from "TT" manual starters for small motors to complete multi-motor CONTROL CENTERS.

TRUMBULL-PIONEERED VERTICAL CONTACT design prevents dust and carbon troubles.

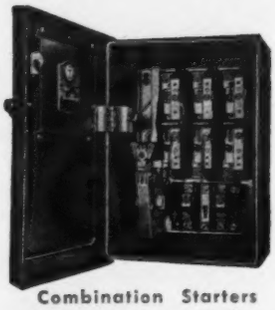
WIRING, INSPECTION, REMOVAL and REPLACEMENT of parts FROM THE FRONT saves installation and maintenance time.

COMPACT, SPACE-SAVING COMBINATIONS include starter and disconnect in same box.

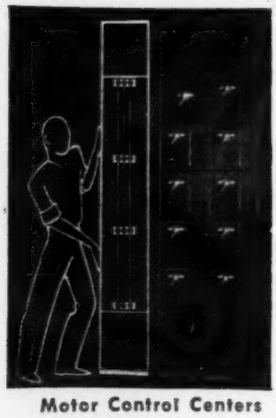
"BUILDING-BLOCK SIMPLICITY" in laying out centralized multi-motor control installations with Trumbull "packaged" stock-unit-type MOTOR CONTROL CENTERS.

TRUMBULL

MOTOR STARTERS



Combination Starters (Magnetic starter & disconnect)



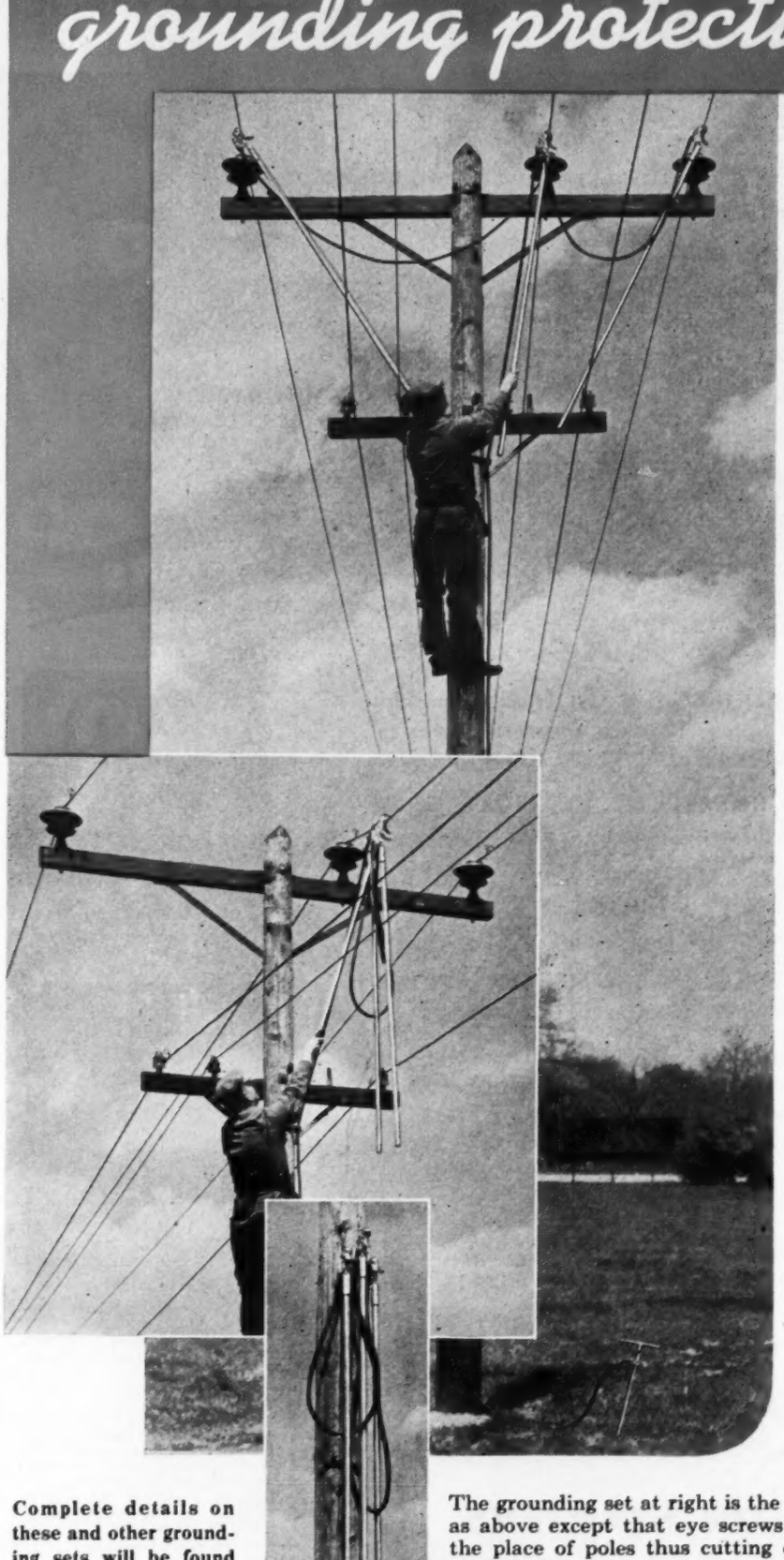
Motor Control Centers

• Whether you need a starter for a single small motor or a modern control center layout for an entire production line . . . look to Trumbull. We will be glad to send you Motor Control literature upon request. Ask for Bulletins 404 & 411.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY • PLAINVILLE, CONN. • A GENERAL ELECTRIC ORGANIZATION

OTHER FACTORIES AT NORWOOD (CINN.) O. – SEATTLE – SAN FRANCISCO – LOS ANGELES

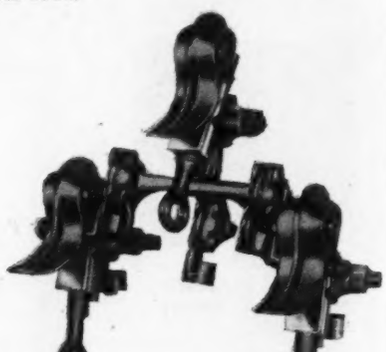
grounding protection FOR MANPOWER



TIPS GROUNDING SETS protect linemen working on "cold" lines.

Linemen making repairs on supposedly "cold" lines are entitled to the best in grounding protection and Tips Snap-On grounding sets have for years provided substantial grounds that can be depended upon for protection against unexpected current surges. The clamps snap on with minimum arcing and screw up tight on the conductor by turning the poles or eye screws. Jumper pressure contacts are tightened with a wrench before hand. There are no loose contacts as in the case of grounding chain.

This grounding set is mounted on laminated wood poles or furnished with eye screws for application with Grip-All or similar clamp stick. The method of applying the mounted set is illustrated at left from bottom to top. Most companies recommend that two sets be used — one on each side of area where linemen are working. The Tips grounding clamps used in these sets are capable of withstanding amperage in excess of the maximum for 2/0 ground cable. The poles will withstand 75,000 volts per foot.



The grounding set at right is the same as above except that eye screws take the place of poles thus cutting down the weight.

Complete details on these and other grounding sets will be found in the grounding section of your Tips Tool Catalog No. 8. More copies available.

A·B·CHANCE CO·
CENTRALIA, MISSOURI.

ABC INDUSTRIES

Solder Dispenser Easily Made

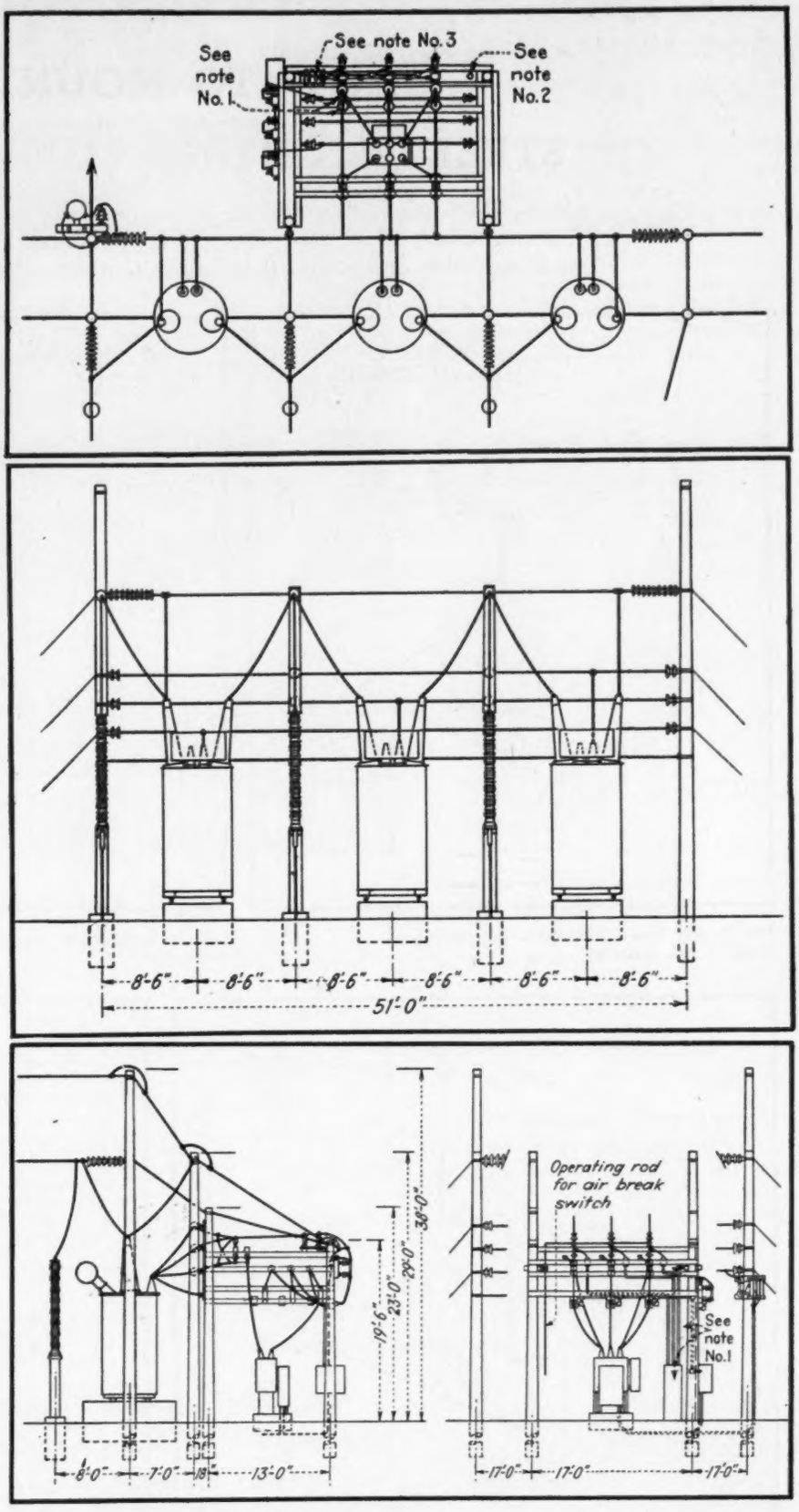
A pencil-type solder dispenser has been devised to prevent contamination of solder from handling and dirt. It was made of a piece of methyl methacrylate resin tubing. The brass nozzle is cemented into the body of the tubing with a press fit. Before loading the

solder into the dispenser, it is form wound on a drill rod in a bench lathe. The operator pulls the solder from the dispenser with pliers as it is needed. The device was developed at General Electric's Schenectady Works.

Design for Economy in a 110/4-Kv.

By JAMES A. RAWLS
Construction Engineer,
Virginia Electric & Power Company

Here are plan and elevations of a 110-kv. substation with an ultimate capacity of 7,500 kva. which was constructed by the Virginia Electric & Power Company during 1943 to serve a war customer. It is located at the end of a 2.5-mile, 110-kv., wood "H"-frame tap line which has a 110-kv. air-break switch where it connects to the main line, making it unnecessary to install a switch at the substation. The 110-kv. buses and leads to the transformers in the station are of $\frac{3}{8}$-in. steel (Crapo), which are the same as the line conductors. The 4-kv. buses are of the strain type, consisting of 600,000-cir.mil bare copper wire. The station, while simple, is mechanically and electrically strong, requiring a minimum of critical materials, as well as of man-hours, to construct.



Plan and elevations of a 110-kv. substation

1. Hinge end of switch should be located as shown. Blades can swing in any direction.

2. Switch control rod should go down pole as shown. Timbers and pole to be drilled in field for offset bearing and control mounting. Mounting timbers 5¾ x 7¾ in.

3. Customer to own and install the 4,160-volt underground cables, potheads, ducts and concrete necessary in connection with these ducts in our substation so as to connect to our bus between the bypass switch and the line disconnect switches.

HOW TO MOUNT
STREET LIGHTING LUMINAIRES

Methods for wood-pole mounting of four types and five ratings of street-lighting units, using pipe clamp brackets; adapted from construction standards of United Illuminating Company, New Haven, Conn.

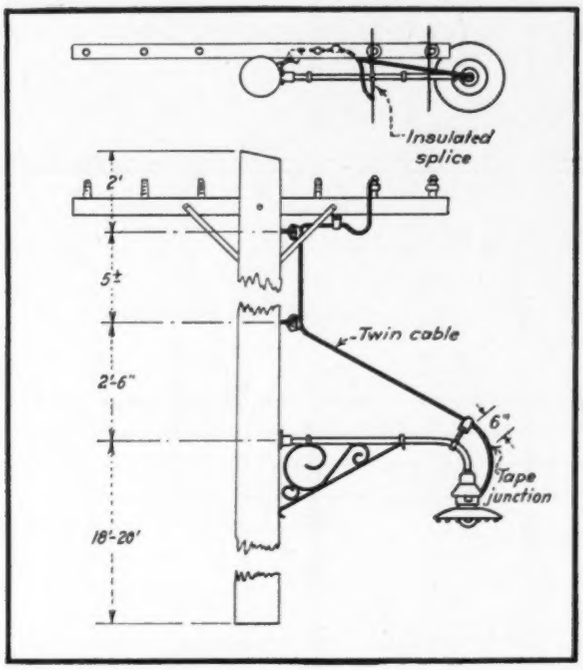


FIG. 1—800 and 1,000-lumen units with radial wave reflector

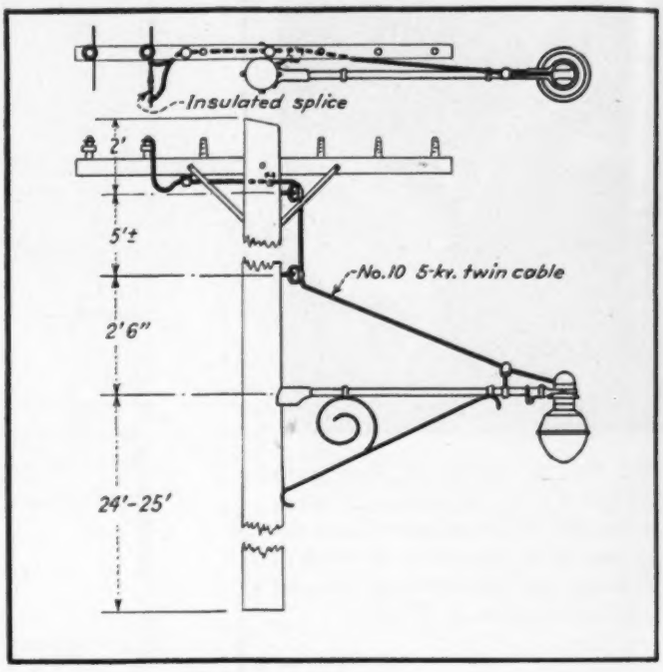


FIG. 2—2,500-lumen unit with reflector and globe

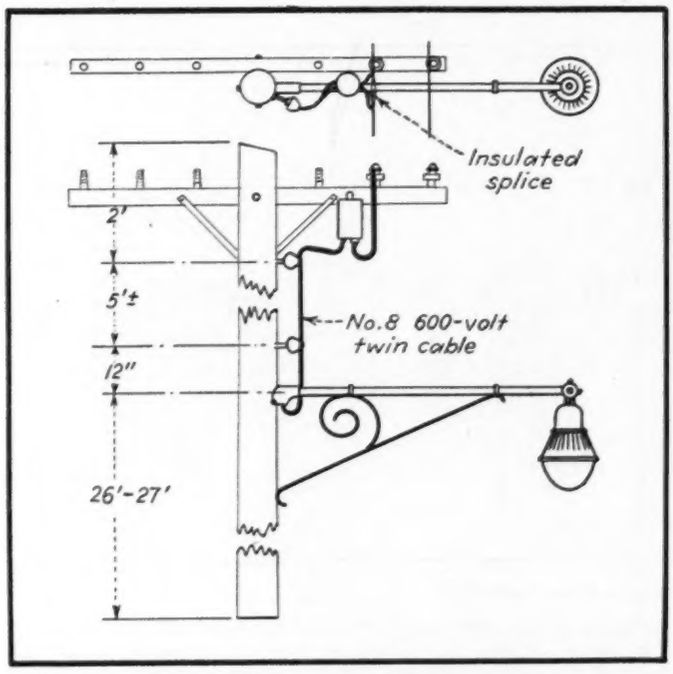


FIG. 3—6,000-lumen unit with spiked head

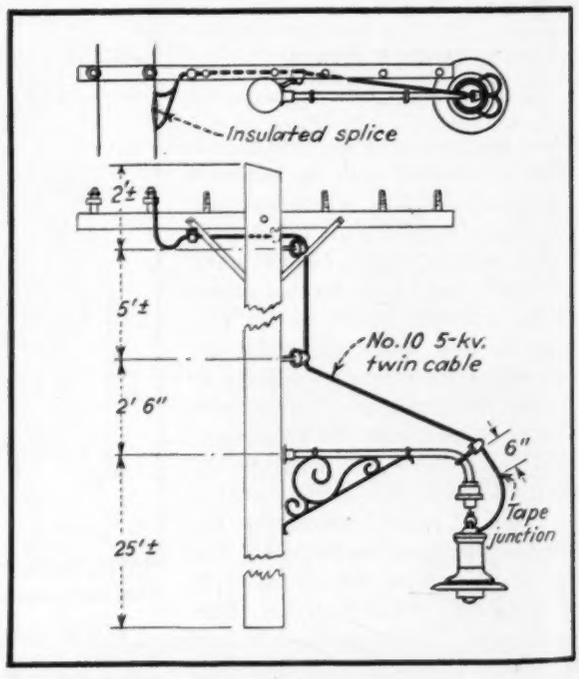


FIG. 4—6,000-lumen unit with form 6 head

WaterFOG puts out fires IN OIL

Because Turning WATER

into the tiniest DROPLETS

MAKES THE MIGHTIEST FIRE FIGHTERS

The smaller a water droplet is, the quicker it will absorb heat from fire.

That's why WaterFOG makes water effective on oil fires. Its water particles are so tiny — having many times greater surface area than an equal amount of water in spray or stream form—that they cool the fire faster.

Also, being lighter, WaterFOG floats in the combustion area, picking up its full complement of heat from the burning vapors and from the liquid's surface. Then, as it changes to steam, it expands, casting a smothering blanket over the fire.

The fire is quenched . . . vaporization is retarded . . . oxygen is kept out. Yet there is no agitating of the liquid, no spreading of the fire. "Flash-back" is prevented, and with smaller quantities used, water damage is restricted. Write for Bulletin 123.

WaterFOG is created by specially-designed Rockwood heads and nozzles, in which impinging streams break water up into FOG. Rockwood engineers will develop the proper particle size, fog pattern and velocity for your conditions. Available in the form of fixed piping installations, hose nozzles and applicators.

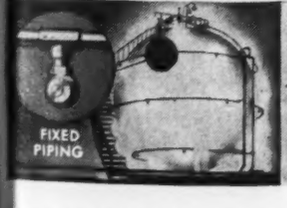
Approved by Underwriters' Laboratories and Associated Factory Mutuals — used by Navy, Coast Guard, U. S. Maritime Commission, hundreds of industrial plants.

Executives! A color movie (16 mm.) showing tests of Rockwood WaterFOG is available.

ROCKWOOD SPRINKLER COMPANY
48 Harlow Street, Worcester 5, Mass.
Specialists in Fire Protection Engineering, Equipment and Installation since 1907

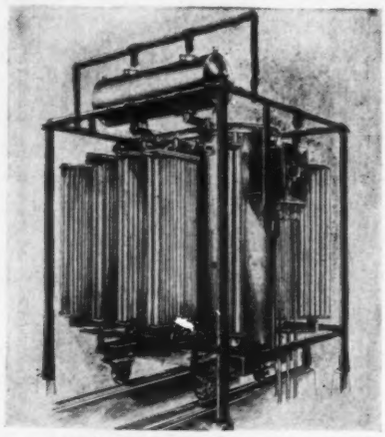
ROCKWOOD WaterFOG

Water Engineered by Rockwood Cools, Confines, Smothers Oil Fires



WaterFOG INSTALLATIONS DOOM ELECTRICAL FIRES!

Full protection against flammable liquid fires is obtained when a WaterFOG system of fixed piping, heads, valves and automatic controls is planned and installed by Rockwood WaterFOG engineers (authorities on hydraulics, as applied to fire protection). Spacing of heads, obstructions, distance between heads and hazard, etc. are important in determining correct particle size, fog pattern and velocity.



Typical installation of Rockwood WaterFOG on transformer. WaterFOG is safe to use on electrical fires!

Typical WaterFOG Applications

- transformers
- oil switches
- control rooms
- generators
- paint shops
- oil storage

etc.

WaterFOG Nozzles for Hose Lines

Rockwood N22 nozzle, attached to ordinary hose lines or used as a tip on play-pipes, converts water into WaterFOG, discharging a large WaterFOG pattern with considerable forward projection. Since the WaterFOG has a very low degree of conductivity, it is safe for fighting fires in oil-filled electrical equipment. Available in 1", 1½" and 2½" sizes.

Rockwood N22 Nozzle

Write for Bulletin 123, giving more complete information on WaterFOG equipment.

EXECUTIVES! A colored movie (16 mm.) showing tests of Rockwood WaterFOG, is available.

Duplex Core Reactor Has Better Control

By E. C. WENTZ
Transformer Engineer, Westinghouse Electric & Manufacturing Company, Sharon, Pa.

Saturating the core of a reactor with d.c. flux to reduce and control its reactance is not a new idea. However, as the demand for large size reactors increased and as wartime ma-

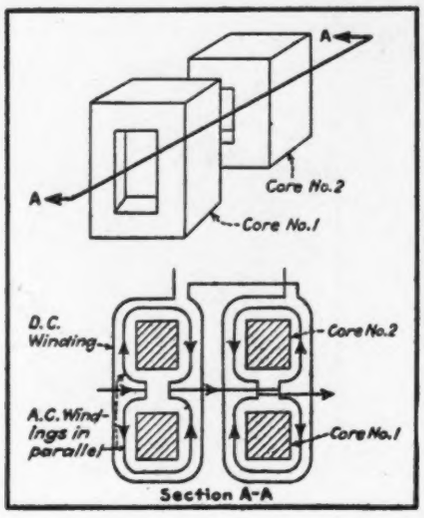


FIG. 1—Construction of saturable duplex core reactor

terial shortages become more acute it became more necessary to work out a better scheme of construction. Fig. 1 shows the result. Two a.c. reactors, each consisting of a pair of coils on a core, are connected in parallel in such a way that the a.c. flux in one core practically opposes the flux in the other core. A single coil placed over both cores is added to this duplex (or tandem) unit. It has zero voltage induced in it and can be used as the d.c. coil. Now the whole core is active and carries both a.c. and d.c. fluxes.

Characteristics of a Hipersil core reactor are generally similar to the old type of three-legged reactor, except that the saturation curves are more definitely marked into zones, as shown in Fig. 2.

In the lower zone (Fig. 2a) the reactor is reasonably linear, because the variation in flux is small and is along the almost flat upper part of the saturation curve (Fig. 2b). As the a.c. current and voltage increase into the intermediate zone the hysteresis loop increases in size; around the knee of the saturation curve, the effective reactance changes during the cycle, and the reactor is no longer linear.

With sine wave voltage applied, the current will be distorted and will have large peak values; with sine wave current, large voltage peaks result.

In the usual application the reactor is in series with a constant load impedance, of the same general magnitude as the reactor impedance. The resulting current (when the reactor is in the intermediate zone) will be non-sinusoidal and the reactor voltage will also contain harmonics. Thus, the reactor generates harmonic voltages which appear across the load; these harmonics actually increase the r.m.s. voltage at the load, to some extent.

When operating in the intermediate zone (Fig. 2c) the fundamental component of reactor voltage is considerably greater if a sine wave of current is maintained than it is if a sine wave of voltage is applied to the reactor with the same r.m.s. value of non-sinusoidal current. This characteristic makes it difficult to calculate the exact load performance of a reactor from the usual saturation curve, since such curves are made with sinusoidal applied voltage. However, the discrepancy is generally not too serious. The actual direct current required

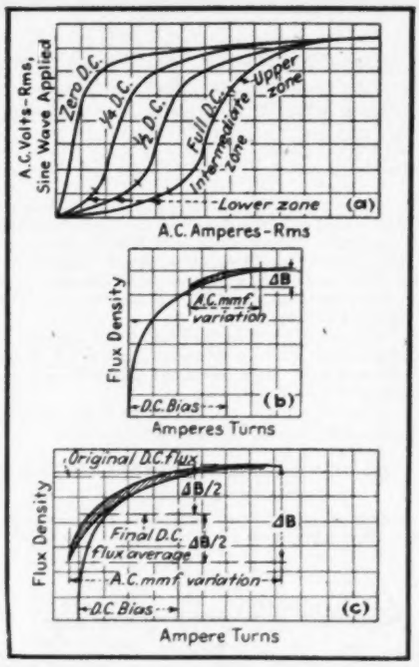


FIG. 2—Saturation curves for saturable reactor; showing flux variation as a.c. mmf. increases

(a) three zones; (b) lower zone; (c) intermediate zone; because the reactors are in parallel the flux variations in the two cores are equal and in time phase, although one flux is increasing and the other is decreasing.

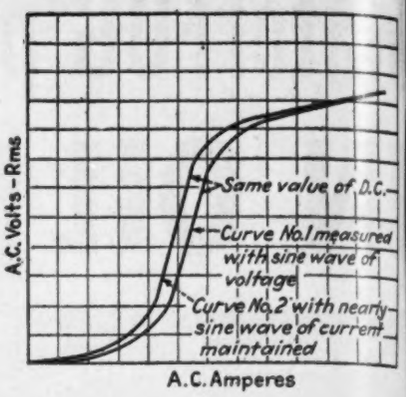

A.C. Volts-Rms
Same value of D.C.
Curve No.1 measured with sine wave of voltage
Curve No.2 with nearly sine wave of current maintained
A.C. Amperes

FIG. 3—Saturation curves showing sine wave and non-sinusoidal current and its effect on voltage

will be only slightly greater than the value calculated from the circuit and saturation curve (see Fig. 3).

Applications of this newly developed saturable core will be presented in a subsequent article.

•

Cut Allowable Size of Service Neutral

Service standards of the Detroit Edison Company, as recently revised, now permit the grounded conductor on three-wire d.c. and single-phase service drops to be two Detroit Edison standard sizes smaller than ungrounded conductors down to No. 8 as a minimum. However, where the secondary is energized from transformers connected in "Y" on the secondary, the grounded wire must be the same size as ungrounded ones.

Standard sizes of wire used by the Detroit utility run as follows: Nos. 8, 6, 4, 2, 0, 0000, 350 MCM. and 500 MCM.

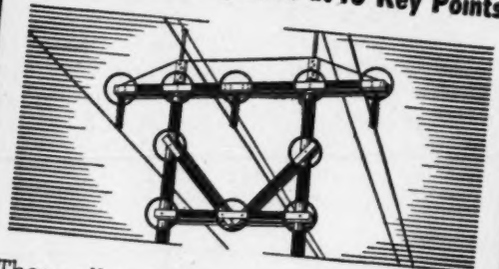
Thus for single-phase service drops wire sizes might be, for example: 2 No. 6 and 1 No. 8; 2 No. 2 and 1 No. 6; 2 No. 0 and 1 No. 4; 2 No. 0000 and 1 No. 2; 2 No. 500 MCM. and 1 No. 0000.

Formerly standards permitted only one size smaller wire on the grounded wire of three-wire d.c. or single-phase services. The change, which was recently made, permits a certain saving in copper. From a service standpoint it is considered that the diversity and balance of present residential load is sufficient to minimize the effects of voltage unbalance that first dictated the use of the large size neutral wire.

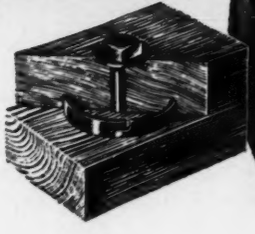
TIMBER H-POLES
For Electric
TRANSMISSION

Sketched from an installation in New York State, erected by the U. S. Engineers and prefabricated by the American Crossarm and Conduit Company, Chicago.

Ring-Connected by TECO at 10 Key Points



These all-timber H-Poles use TECO Timber Connectors at 10 key points to provide greater strength and rigidity. They are designed to withstand the high stresses caused by broken conductors in icy weather. Secure maximum strength in service at lowest cost by using TECO Connected Wooden H-Poles. Let our engineering department assist you on your next transmission line design. *Write for our literature today.*



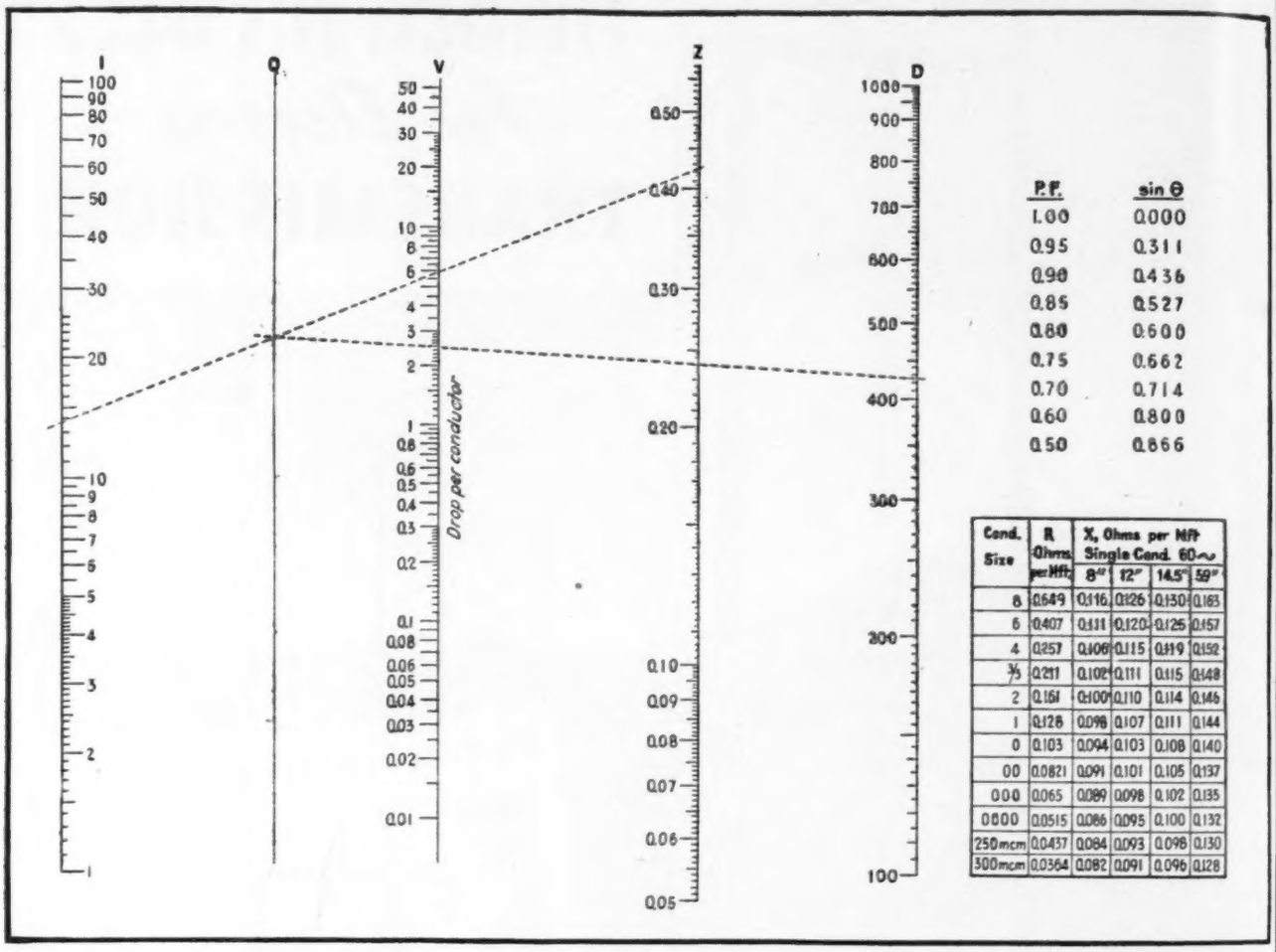
The TECO Ring Connector spreads the load on a timber joint over practically the entire cross-section of the wood . . . brings the full structural strength of lumber into play.

TIMBER ENGINEERING COMPANY

NATIONAL MANUFACTURERS OF TECO TIMBER CONNECTORS AND TOOLS

WASHINGTON CHICAGO MINNEAPOLIS NEW ORLEANS PORTLAND

HOW TO DETERMINE VOLTAGE DROP FOR CONDUCTORS



P.F.	sin Θ
1.00	0.000
0.95	0.311
0.90	0.436
0.85	0.527
0.80	0.600
0.75	0.662
0.70	0.714
0.60	0.800
0.50	0.866

Cond. Size	R Ohms per Mft.	X, Ohms per Mft Single Cond. 60~ 8"	12"	14.5"	59"
8	0.649	0.116	0.126	0.130	0.163
6	0.407	0.111	0.120	0.125	0.157
4	0.257	0.106	0.115	0.119	0.152
3	0.211	0.102	0.111	0.115	0.148
2	0.161	0.100	0.110	0.114	0.146
1	0.128	0.098	0.107	0.111	0.144
0	0.103	0.094	0.103	0.108	0.140
00	0.0821	0.091	0.101	0.105	0.137
000	0.065	0.089	0.098	0.102	0.135
0000	0.0515	0.086	0.095	0.100	0.132
250mcm	0.0437	0.084	0.093	0.098	0.130
300mcm	0.0364	0.082	0.091	0.096	0.128

Conductor voltage drop for a wide range of wire sizes, conductor spacings and load power factors are obtainable from the accompanying nomograph, which solves the general equation:

$$Vd = \frac{I\,(R\cos\Theta + X\sin\Theta)\,D}{1{,}000}$$

for which Vd = Voltage drop per conductor
I = Load current, amperes
R = Conductor resistance, ohms per 1,000 ft.
X = Conductor reactance, ohms per 1,000 ft.
D = Conductor length, feet
Θ = Power factor angle

Values of conductor resistance and reactance for a range of conductor spacings are given in an accompanying table for the most common wire sizes. These values, expressed in ohms per 1,000 ft., when substituted in the expression $Z = R\cos\Theta + X\sin\Theta$, along with values of cos Θ and sin Θ also tabulated for the various common load power factors, will give conductor impedance "Z" also in ohms per 1,000 ft.

In determining voltage drop for a specific case, place a straight edge from the current in amperes on the "*I*" scale to the proper value of conductor impedance—calculated from the above relationship—on the "Z" scale. From this intersection on the "Q" scale a line connecting with the distance in feet on the "D" scale will intersect the "V" scale as the desired value of voltage drop per conductor.

Chart prepared by Hugh Lawyer, Oklahoma Gas & Electric Company

Simplex-Tirex Flexible Cords and Cables

Now Have *"Synthetic Rubber"* Insulation and Sheath

Many of the industries now classed as "essential" have used millions of feet of TIREX – rubber sheathed – cords and cables. During the war their demands for Tirex have increased to such an extent that little has been left for normal commercial uses. Mines, shipyards, railroads, and other vital war activities have needed every foot that could be made.

At the same time, the sources of supply of natural rubber have been cut off and available stocks have been reduced until rubber can be used only for purposes where no substitute can be found. It can no longer be used in sheath compounds for cable – and only in insulation for a very few types of cable where service requirements preclude the use of synthetic materials. Synthetic insulations and sheaths have replaced rubber compounds and the new materials have, in many instances, exceeded expectations both mechanically and electrically.

In flexibility, toughness, abrasion resistance and safety, the Tirex of today – we call it "WAR-TIREX" – approximates prewar TIREX standards. In essential industries doing important war work Simplex WAR-TIREX cords and cables are doing an outstanding job. Performance records indicate that synthetic insulations and sheaths may have an important place in postwar work.

If you need flexible cords or cables for portable electrical tools or mobile equipment, we shall be pleased to tell you how Simplex WAR-TIREX can serve you.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge 39, Mass.

ARMY E NAVY

Simplex

WIRES and CABLES

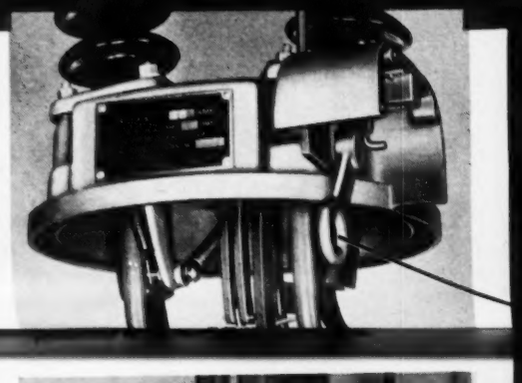
THE KYLE Oil Circuit Breaker GIVES MAXIMUM PROTECTION COMPLETE SAFETY AND LONG LIFE

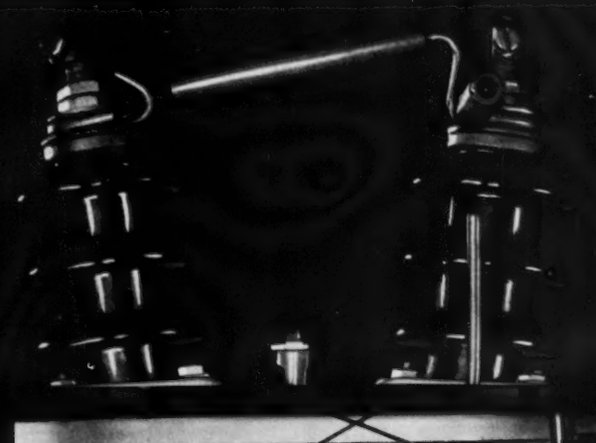
The Kyle Oil Circuit Breaker is designed to provide utmost protection for the line by the use of a trouble-free hydraulic mechanism. There is no clockwork, no motors.

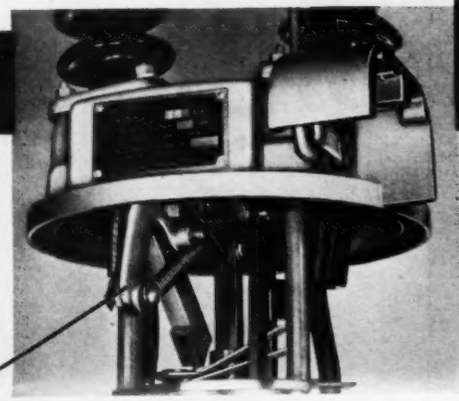
The Kyle Circuit Breaker is electrically and mechanically sound. It has a high interrupting capacity and will not fail in protecting the line.

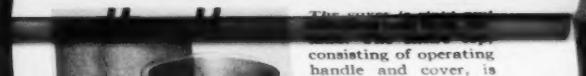
It is safe from the standpoint of danger to operators or linemen because the mechanism is insulated from the tank.

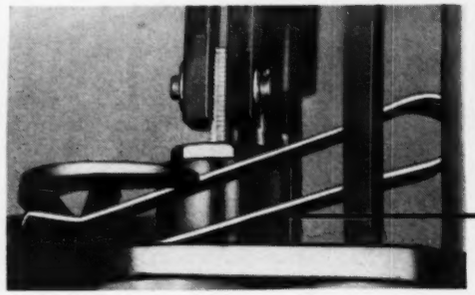
The mechanical construction assures long life, ease of operation, and unusual resistance to wear and deterioration. It is the only circuit breaker with positive, dependable hydraulic timing.



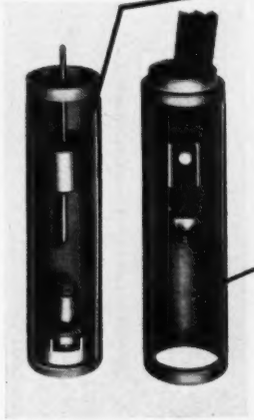




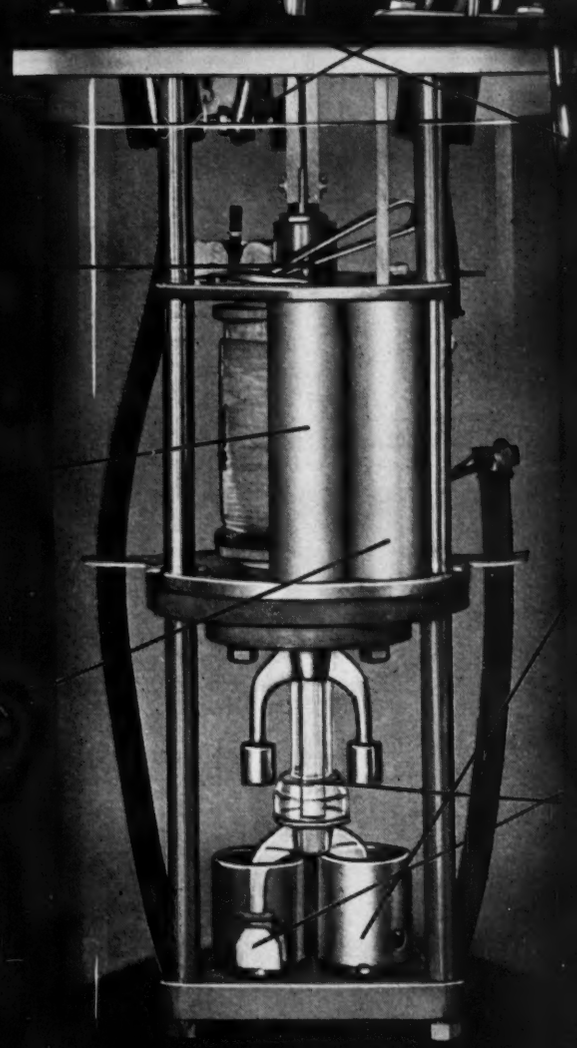


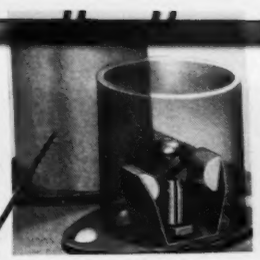


A thermal trip set at 200° F. is provided to prevent damage to insulation should overheating occur. This consists of a bi-metal strip, located just under the release trigger. As temperature increases, the free end of the bi-metal strip raises until it trips the release trigger and causes the breaker to lock out. This prevents burn-up from heavy overload.



The retard piston (right) which is attached to the contact closing mechanism through the bakelite tie link, rides in the cylinder as shown. The piston moves up after contacts open. Reclosing of the contacts is hydraulically delayed by restricting oil flow past the piston while in the upper cylinder; and when the piston reaches the lower cylinder, free drop results in fast closing of the contacts eliminating burning. The release piston (left) is actuated upward by the pumping of oil under the piston in measured amounts. The plunger acts as the pump, making an injection each time the breaker opens and after four operations in succession the piston is driven high enough to trip the release latch opening the breaker to the lockout position. If it is not necessary for the breaker to lock out, the release piston settles back to its initial position.

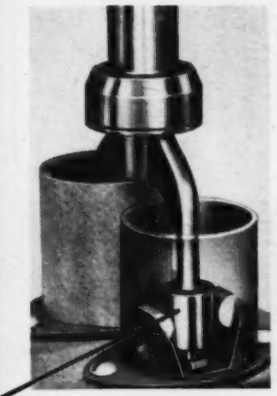




consisting of operating handle and cover, is dead. The tank is dead and provisions are made for grounding it.

•

Contacts are unusually well protected against flashover with a fiber protecting cup. Note the split type lower stationary contacts, which fit cup-like into the upper movable contacts. The special arcing tips which ride on the outside of the upper movable contacts eliminate burning of the main current carrying surface. The load is always carried on clean contacts.



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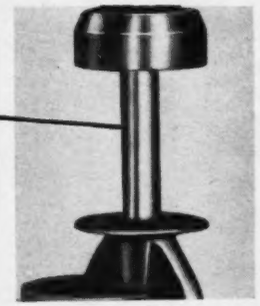
By incorporating a double break, the rupturing capacity of the breaker is increased and a reduction made in the burning of contacts. Inasmuch as the lower current-carrying contacts do not burn, the upper contacts and consequently the plunger returns always to the same position. This means that the relation of the plunger to the coil is constant, thereby resulting in constant tripping characteristics.



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When a fault occurs, the coil, which is in the breaker circuit as long as the contacts are closed, is sufficiently energized to raise the steel plunger which normally rests upon the top of the contact member. The plunger on moving into the coil finally imparts a hammer blow to the contact tie rod, raising the contacts and producing a very fast break with the minimum of arcing.

KYLE KC CORPORATION

SOUTH MILWAUKEE, WISCONSIN

ONE-HAND ACTION

Portable, lightweight, Randolph "4" is designed for one hand, self-aimed operation. With no hoses to twist, valves to turn, horns to raise—this extinguisher is PANIC PROOF.

Especially adapted for bracketing in shops, shipyards, power plants, automotives.

IN fighting machine, electric, flammable liquid fires—ACTION counts! With the Randolph "4", it's ACTION you get—*quick—thorough—easy!*

Just AIM—touch the trigger—and powerful carbon dioxide charges into the flames—smothers the fire in a penetrating, icy blanket.

Randolph "4" carbon dioxide is SAFE. Does not conduct electricity—will not damage food, equipment, or machinery. *Approved, labeled by Underwriters' Laboratories, Inc.*

Mobilize your fire protection with Randolph "4". For prompt delivery, phone your nearest supply house or write Randolph Laboratories—today.

NOW PUBLISHED—*Send for free, illustrated booklet "Sharpshooting at Flames." Explains latest techniques in fighting fires with carbon dioxide.*

RANDOLPH LABORATORIES, *Inc.*

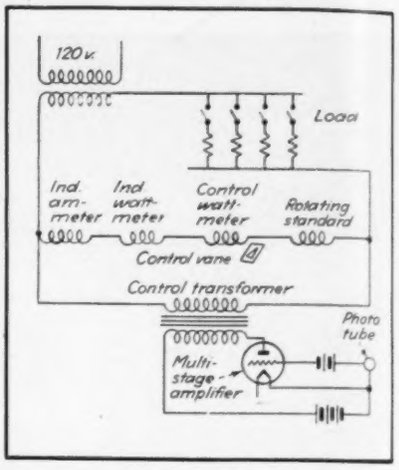
8 EAST KINZIE STREET, CHICAGO 11, ILLINOIS, U.S.A.

Wattage Control for R. S. Calibration

C. G. HOLLER

Meter Superintendent, Mississippi Power & Light Company, Jackson, Miss.

Constant voltage is considered to be a requisite for calibration of rotating standards against indicating instruments. Usual practice includes manual regulation of voltage to hold the wattmeter pointer at the proper value. This may be quite difficult if the supply potential does not remain on a fairly straight line.



CIRCUIT SCHEME for automatic wattage control of rotating standard calibration

But control of potential is not the only way to hold wattage constant. It can be done also by control of current. The accompanying diagram shows a circuit scheme used in the meter laboratory of the Mississippi Power & Light Company to maintain constant wattage by automatic control of current, compensating for changes in voltage.

The current circuit includes a control watt-hour meter in addition to the precision ammeter and wattmeter and the rotating standard. The four instruments in series are shunted by the secondary of a transformer. The current set by the load box divides between the coils of the instruments and the shunt around them in inverse proportion to the impedances of the two paths. If the impedance of the shunt path is changed the current through the instruments changes with it. By putting a direct current through the primary of the transformer the impedance of the secondary may be changed and the current in the calibration circuit thus controlled.

15-KW OF HIGH-SPEED ELECTRONIC HEAT

WITH THE NEW RCA 15-B

IN nearly every case where electronic power has been applied for heating, important savings in time have resulted. The high-frequency power generated by the new RCA 15-B is suited to heating a wide variety of non-metallic substances because of the wide choice of frequencies it offers — from 2 million to 10 million cycles per second.

Why Electronic Heating? When high-frequency electricity is applied to non-metallic materials, it heats them — *all the way through*. For example, a block of wood can be heated uniformly by high-frequency power while with ordinary heating methods, the heat would have to "seep" in from the outside.

The uniformity of electronic heating makes it possible to introduce heat at a high rate. Processes that once took hours can now be completed in minutes.

The uniform heating often means better uniformity in the finished product, and little or no internal stresses to cause warping.

What Materials Can Be Heated? Wood, plastics, paper, glass, rubber, foods, chemicals, tobacco, ceramics — and many other industrial materials can be heated electronically.

How Much Heat Will the 15-B Give? The new RCA 15-B electronic generator is rated at 15 kilowatts output. It will deliver up to about 50,000 B.T.U. per hour, depending on the load conditions.

Easy to Operate. The 15-B is push-button controlled. Once the correct processing procedure is established, any intelligent operator can use it with ease. RCA field engineers are available to help with your application problems.

Get the Full Story. A comprehensive 12-page descriptive catalog on the RCA 15-B generator is yours for the asking. Use the convenient coupon below. If you have a specific application for electronic heat in mind, write, stating particulars, to RCA, Electronic Apparatus Section, Camden, New Jersey.

RCA

RCA ELECTRONIC HEAT

RADIO CORPORATION OF AMERICA

FREE

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RCA, Electronic Apparatus Section, Camden, N. J.

Please send me details on the new RCA 15-B electronic generator.

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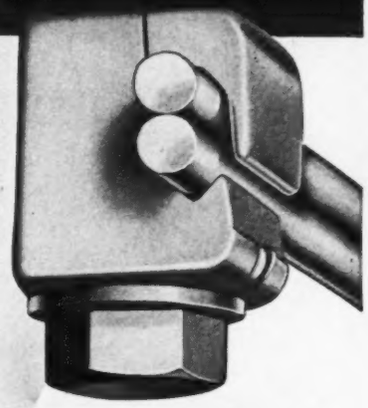
Rush job?

HERE'S HOW

FARGO CONNECTORS save time 4 Ways!



1 NO LOOSE PARTS to fall off. Fargo is the original one-piece connector.

2 ALWAYS THREADED, the Fargo Connector is always ready to tighten the tap. Saves time!

3 CAREFUL MACHINING makes Fargo threads easy turning, gives you permanent high pressure contacts at low wrench torque.

4 QUICK DELIVERY to your job site on any good priority assured by ample Fargo Connector stocks.

Made by **FARGO MFG. CO.**

Distributed by

LINE MATERIAL CO.

MILWAUKEE • WISCONSIN

The control watt-hour meter is stopped from rotation by a spring, so that it is, in fact, a wattmeter. Attached to its disk and extending out from it is a vane with a slot cut in it in the shape of a narrow triangle. The apex of the triangle points in the direction of rotation of the disk so that a light beam passing through the slot and impinging on a photoelectric cell is less and less intercepted as the load on the wattmeter is increased. Current through the phototube produces a change in the grid bias of an amplifier whose plate circuit is connected in the transformer winding. Thus the current through the calibration circuit is made responsive to the indicated watts and changes in voltage are compensated for.

This method of control introduces some distortion in the shape of the current wave. This is not objectionable because the voltage on the potential coils of the meters can be considered to be free of corresponding distortion or any other harmonics and therefore no harmonic power is in the circuit.

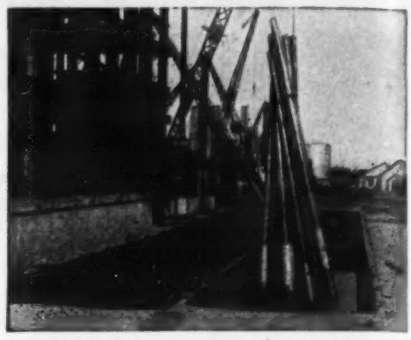
Constants of a circuit like this are very difficult to calculate and the best way to set it up is literally to cut and try because success depends very largely on the shape and size of the triangular slot in the vane as well as on the intensity of the light source. The focal point of the light beam should be in the plane of the vane and close to the apex of the slot for best operation. The control wattmeter should operate at practically maximum torque at all times. This means that the current through it should be kept at about 5 amp. for light load tests. This is done by a current transformer. The same result might be obtained by making the phototube and light beam assembly adjustable so that it could be moved to the mean position of the vane at light load.

The regulating transformer is a General Electric—type Y-1532-A, specification number 6379937—step-up current transformer rated 20-ma. primary, 5-amp. secondary which was designed originally for use with an ammeter to measure current in rubber glove testing. The control wattmeter is made from a 5-amp., 115-volt, 2-watt, single-phase watthour meter. The phototube and amplifier assembly is a Westinghouse type LE photoelectric relay. The relay coil is disconnected and the regulating transformer connected in place of it.

PERMATOX "A"

(A Straight Toxic Wood Preservative)

. . . an answer to the "pole shortage"



Typical full-length dipping vat for the treatment of Poles with PERMATOX "A"

The critical lumber scarcity makes it imperative to treat all new poles . . . as well as to reclaim and re-use old poles by trimming away decayed parts, then dipping, spraying or brushing the clean surfaces with PERMATOX "A" (5% pentachlorphenol in suitable petroleum solvents).

•

This treatment is also effective for cross-arms, ties, racks, crossing planks, bridge timbers and other exposed construction. It insures control of decay and attack of termites or other pests.

PERMATOX "A" is available in *economical concentrates,* (1 to 5 and 1 to 10), for saving freight costs in long shipments.

•

Furnished in Two Forms:—

DOWICIDE 7

Pentachlorphenol* crystals

PERMATOX "A"

5% Pentachlorphenol* in suitable petroleum solvents

*Manufactured by The Dow Chemical Company

Write for Bulletin

A. D. CHAPMAN & COMPANY, INC.

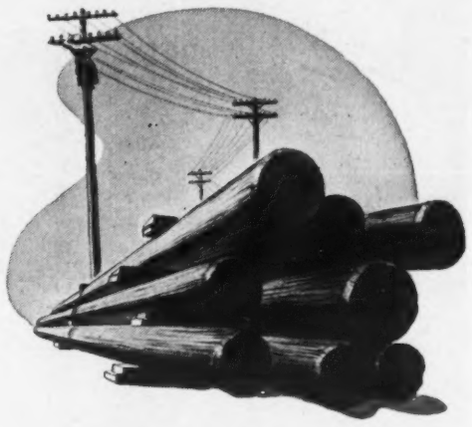
333 N. MICHIGAN AVE., CHICAGO 1, ILL.

Memphis Portland

New Orleans New York

STRONG DOSE OF ROT RESISTANCE!

The Dowicides are doing an outstanding job of controlling decay of all kinds in many industries. The 17 related products that have proven themselves so well in the paint, paper, leather, and textile fields are also providing a "strong dose of rot resistance" for the products of the lumber and electrical industries.



Dowicide in oil solution is a highly effective and permanent preservative for wood products. The treated lumber is paintable, non-bleeding and easily handled by workmen. Application of Dowicide 7 is made either by pressure impregnation or by open tank soaking methods. Protection against rot and termite attack is assured for long periods of time. Complete information on how Dowicide can be applied is available on request.

THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN

New York • Boston • Washington • Philadelphia • Cleveland
Detroit • Chicago • St. Louis • Houston • San Francisco
Los Angeles • Seattle

Dow announces the opening of a Detroit office to serve this important industrial area

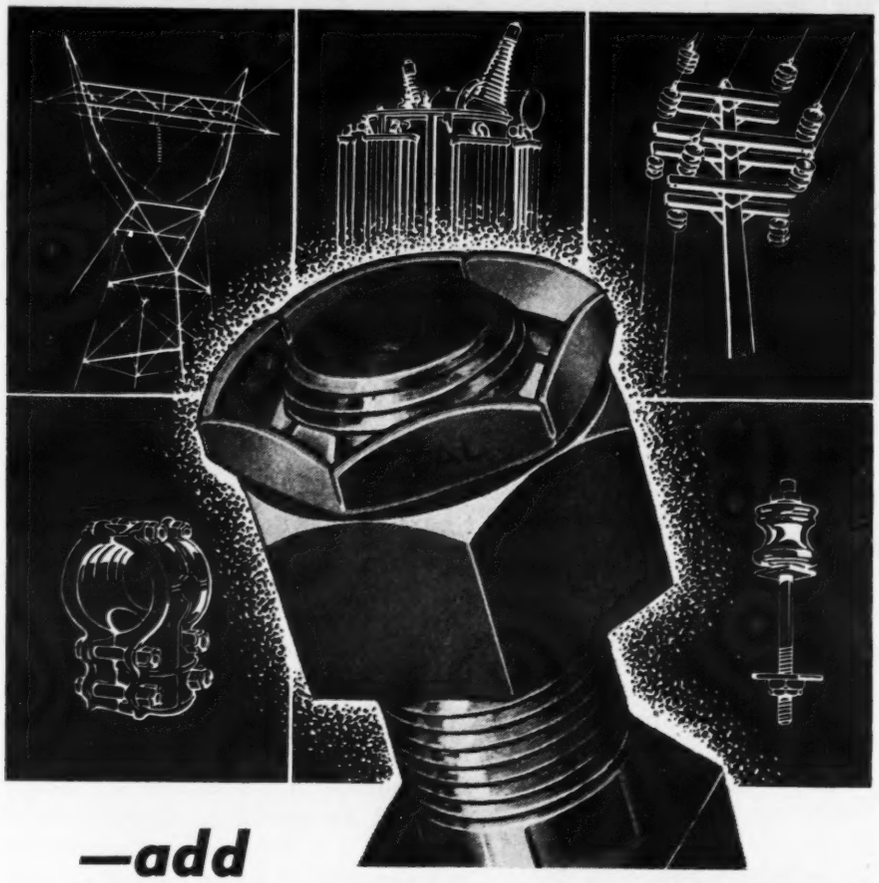
DOWICIDE

GERMICIDES AND FUNGICIDES

DOW

CHEMICALS INDISPENSABLE
TO INDUSTRY AND VICTORY

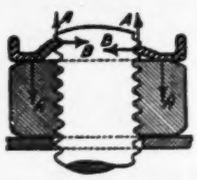
Where Assemblies MUST stay tight—



—add DOUBLE LOCKING PALNUTS!

Tight assemblies and connections are vital in power transmission, distribution and electrical equipment. Fortunately, there is a simple, effective, low-cost answer to this problem . . . Double Locking PALNUTS, used for years on wood pole lines, steel towers, transformers, switches, bus fittings and connectors and other electrical equipment.

PALNUTS are single thread locknuts, of tempered spring steel or Duronze. Quickly applied on top of regular nuts, they hold parts to original tightness, despite severest vibration. PALNUTS are light in weight, low in cost, require only 3 bolt threads space, may be re-used. Specify PALNUTS on equipment you buy—use them on equipment you build. Write for PALNUT Manual No. 1 giving full details.



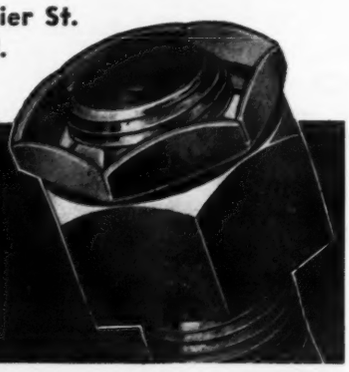
DOUBLE LOCKING ACTION

When the PALNUT is wrench-tightened, its arched, slotted jaws grip the bolt thread like a chuck (B-B), while spring tension is exerted upward on the bolt thread and downward on the regular nut (A-A), securely locking both.

THE PALNUT COMPANY 51 Cordier St. Irvington, N. J.

Used Today on Aircraft, Tanks, Jeeps, Military Vehicles and other War Equipment

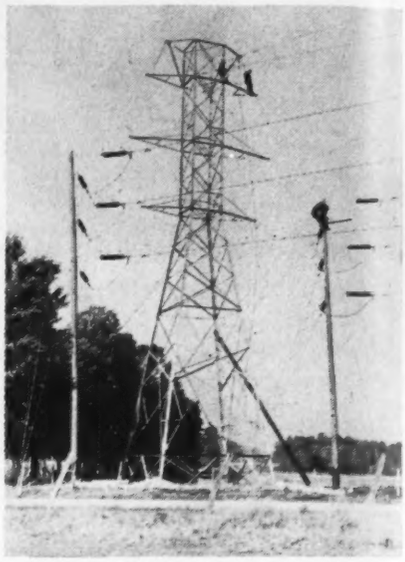
DOUBLE-LOCKING **PALNUTS**



Put Angle Tower on Even Keel

Accompanying illustration shows final stages in the process of straightening an angle tower on the 132-kv. Sheyboygan-Fond du Lac transmission line of the Wisconsin Power & Light Co.

A few months ago the outside legs of this tower, which is subjected to a heavy side strain, pulled through the



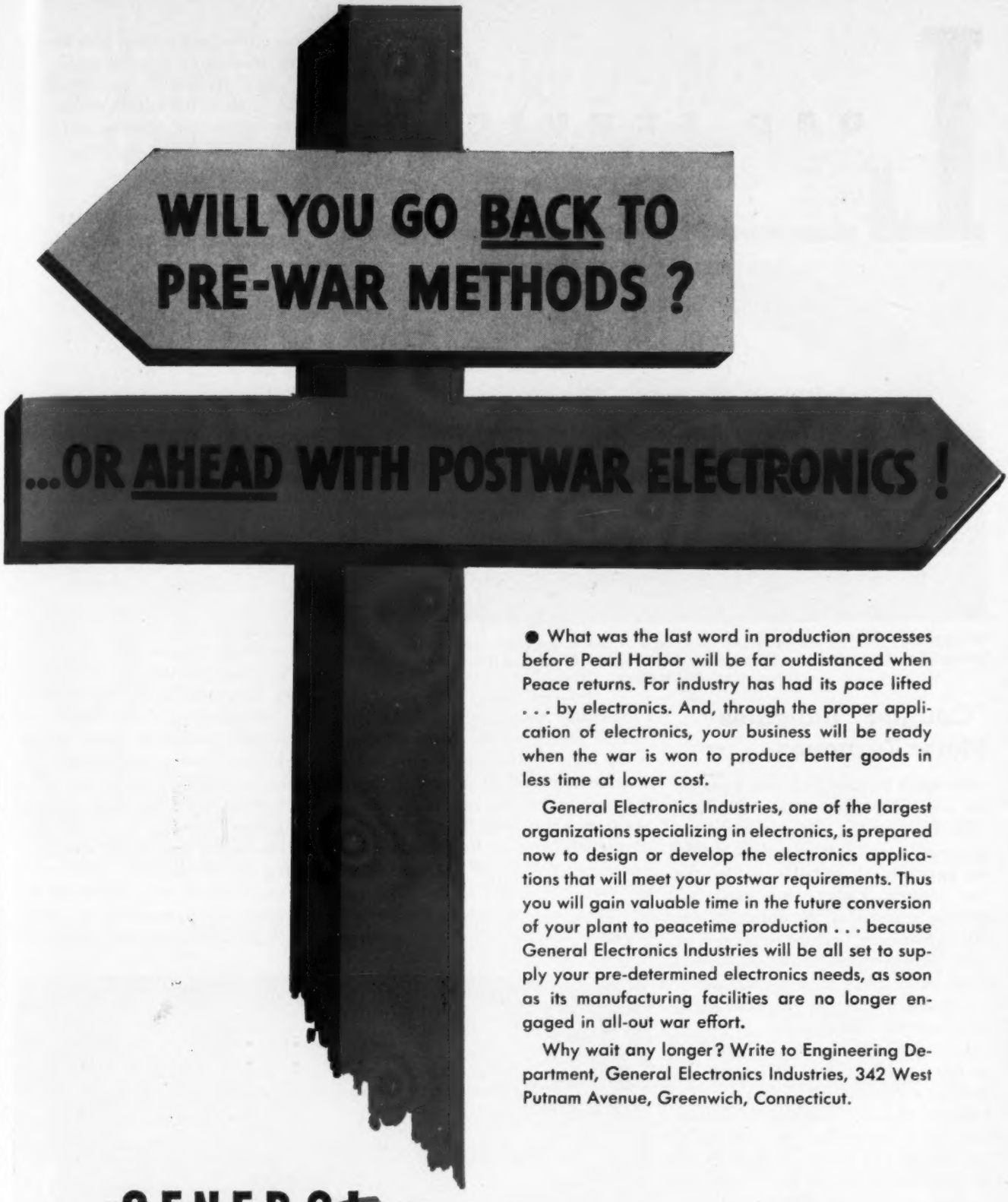
TEMPORARY POLES hold conductors while 132-kv. angle tower is straightened; tower is shown plumb; men are preparing to return conductors to original position

earth back-fill to throw the top of the tower 42 in. out of plub. During the process of straightening the tower service was interrupted only briefly while the conductors were shifted from the tower to temporary poles and back again.

After the conductors had been transferred to temporary poles, as shown, earth was dug from around the stub legs of the tower until the concrete foundations 12 ft. below were exposed.

With the tower again plumb, legs of the stub were encased in concrete to provide a powerful anchor, when covered with back-fill. Where the clay soil was found hard and compact it was possible to undercut, making the holes larger at the bottom than at the surface, thus providing extra holding power. Quicksand was encountered in excavating around one inside leg, and here sheet piling was used as a form while concrete was poured.

In transferring conductors to and from the temporary poles a ½-in. wire rope from a truck-winch line was used.



● What was the last word in production processes before Pearl Harbor will be far outdistanced when Peace returns. For industry has had its *pace* lifted . . . by electronics. And, through the proper application of electronics, *your* business will be ready when the war is won to produce better goods in less time at lower cost.

General Electronics Industries, one of the largest organizations specializing in electronics, is prepared now to design or develop the electronics applications that will meet your postwar requirements. Thus you will gain valuable time in the future conversion of your plant to peacetime production . . . because General Electronics Industries will be all set to supply your pre-determined electronics needs, as soon as its manufacturing facilities are no longer engaged in all-out war effort.

Why wait any longer? Write to Engineering Department, General Electronics Industries, 342 West Putnam Avenue, Greenwich, Connecticut.

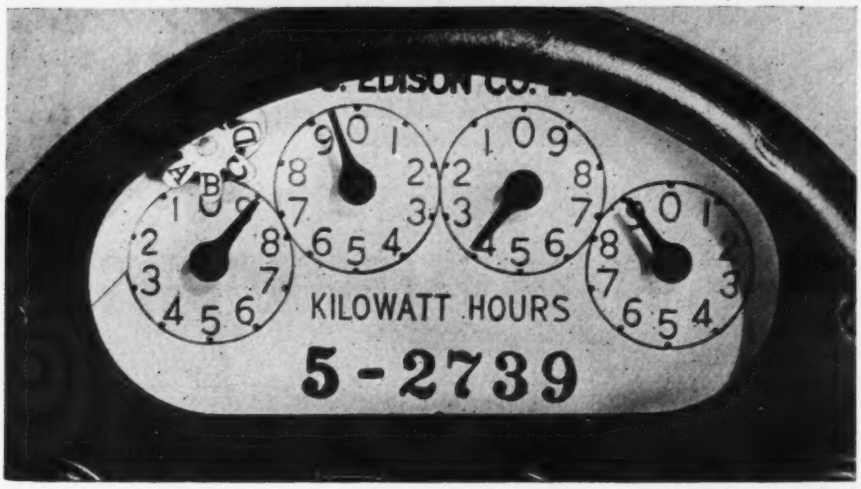
GENERAL *Electronics* INDUSTRIES

TRADE-MARK REG. U.S. PAT. OFF.

GREENWICH • STAMFORD • BRIDGEPORT • NEW MILFORD • NEW YORK

LOAD SERVICING

Industrial • Commercial • Rural • Residential



INDICATING DEVICE shown above left-hand dial checks meter turnover under wartime bi-monthly billing. The cogwheel type indicator makes in effect a five-dial out of a four-dial register

"Counter" Indicates Meter Turnover

In order to save tires and equalize the loss of personnel, the Southern California Edison Co. decided some time ago to read certain meters, chiefly on agricultural installations in the San Joaquin Valley, once each two months instead of monthly. It was found, however, that the consumption on a large number of meters was as great as to cause them to turn over, or repeat, during the two-month period between readings.

Under normal conditions a problem of this kind would be solved by installing a register with a multiplying constant of ten. However, the critical material shortage and the element of time would not permit the delivery of the new registers from meter factories in time to make the change of reading dates effective when desired.

To meet this emergency, Edison's shop and test division developed and manufactured a sufficient number of "register repeat counters" which could be attached to the registers of those meters. Information available in commercial records indicated the meters most likely to turn over during the two-month period between the consecutive meter reading dates.

This device, which can be attached to the register without affecting meter accuracy, is held in place by one of the register holding screws and is so positioned that each time the pointer of the left-hand or slow-moving dial advances through "0" at the top of the dial, one finger of the indicator will be advanced. These fingers are designated by letters stamped on each so as not to be confused with the four-digit reading on the dial itself.

Use of the device was extended to other parts of the Edison system when bi-monthly meter reading and billing went into effect Aug. 1, 1943.

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Farmers Save Hay the Electric Way

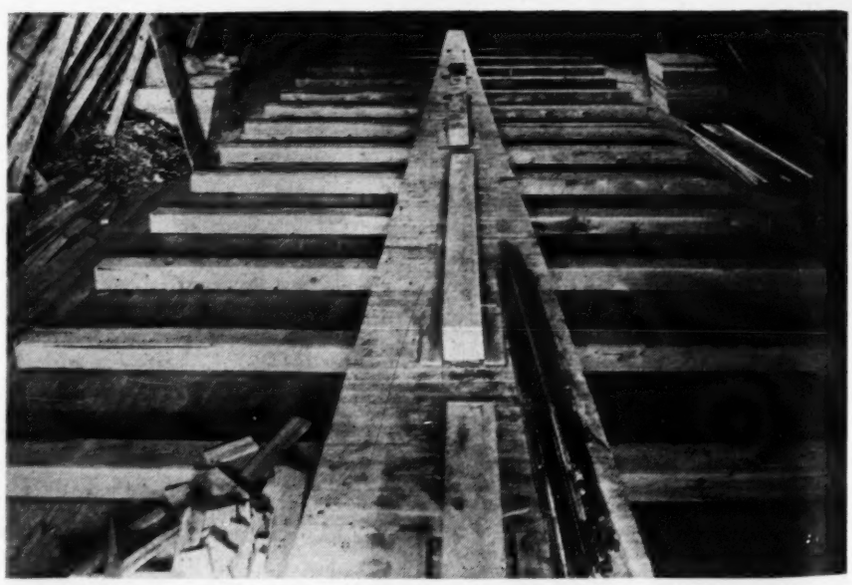
By L. L. KOONTZ

Division Rural Supervisor,
Appalachian Electric Power Co., Bluefield, W. Va.

Most farmers know that a hay crop loses considerable of its natural feeding value when cured in the field. Frequently an entire cutting is completely lost. According to farmers' own estimates, field curing imposes an average 25-percent loss due to unfavorable weather conditions.

Relief from this situation was first introduced to Virginia farmers in 1940 through the co-operation of the Rural Service Department of the Appalachian Electric Power Co. and the agricultural engineering department of Virginia Polytechnic Institute and other interested agencies. By taking full advantage of the research work previously carried on at the Agricultural Experimental Station, Knoxville, Tenn., a system of mow curing was worked out and adapted to meet Virginia conditions.

The forced-ventilation method of curing hay in the mow, as it is now known, is readily adaptable to all sizes and types of farms where hay is produced. The average installation cost is



MAIN AIR DUCT and distribution laterals on mow floor

Why L-M ROUND-WOUND Distribution Transformers Give You

Improved Regulation at All Power Factors—Better Ratio of Losses Uniformly Longer Service Life—Uniformly Lower Exciting Current

Here is the L-M Round-Wound Core and Coil that makes L-M performance possible.

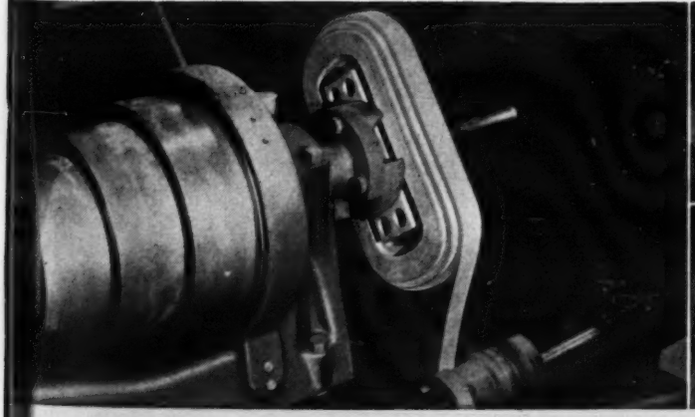
L-M Round-Wound construction of the core and coil produces a distribution transformer that is mechanically strong, rigid and compact. The core of strip steel has great mechanical strength and permanence. The round, machine-wound coils are inherently solid with a minimum amount of bulge.

L-M Round-Wound construction is a close approach to the ideal magnetic circuit. It takes full advantage of *low core loss* silicon steel together with the characteristics of "with grain" direction. Elimination of air gaps in the magnetic circuit gives appreciable *reduction in exciting current.*

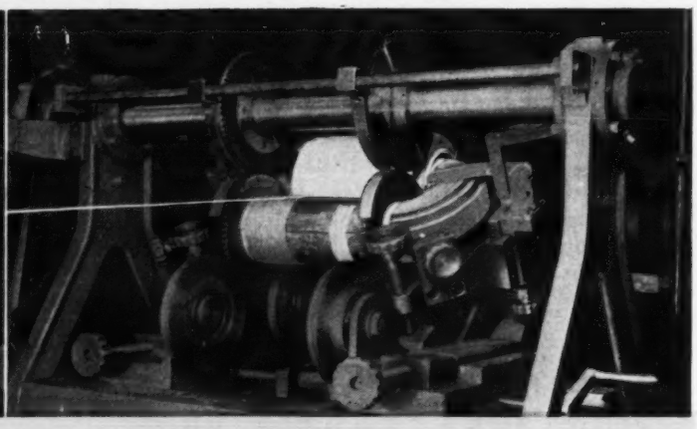
The long, thin, wound type of coil has *low reactance* due to the shape of the coil and the minimum amount of bulge in the winding. *Uniform impulse strength* is provided by elimination of damage to insulation in the machine winding process.

The result of this unique L-M Round-Wound construction is to give a precisely balanced magnetic unit that provides improved regulation at all power factors . . . better ratio of losses . . . uniformly longer service life . . . uniformly lower exciting current, and delivers better voltage to the customer.

Let the L-M Field Engineer show you how L-M Round-Wound construction gives higher short-time overload capacity, gives greater immunity to lightning damage and has lower copper losses and lower total losses. Detailed engineering data is available. We invite you to send for it. Write to Line Material Company, Milwaukee, Wisconsin.



Winding the L-M Round-Wound Core. Air gaps in the magnetic circuit are eliminated. Core is not disturbed after annealing.



Winding the Round-Wound Coil directly onto the wound core. Round coils are ideally shaped to resist magnetic forces under short circuit conditions.

L-M DISTRIBUTION EQUIPMENT INCLUDES:

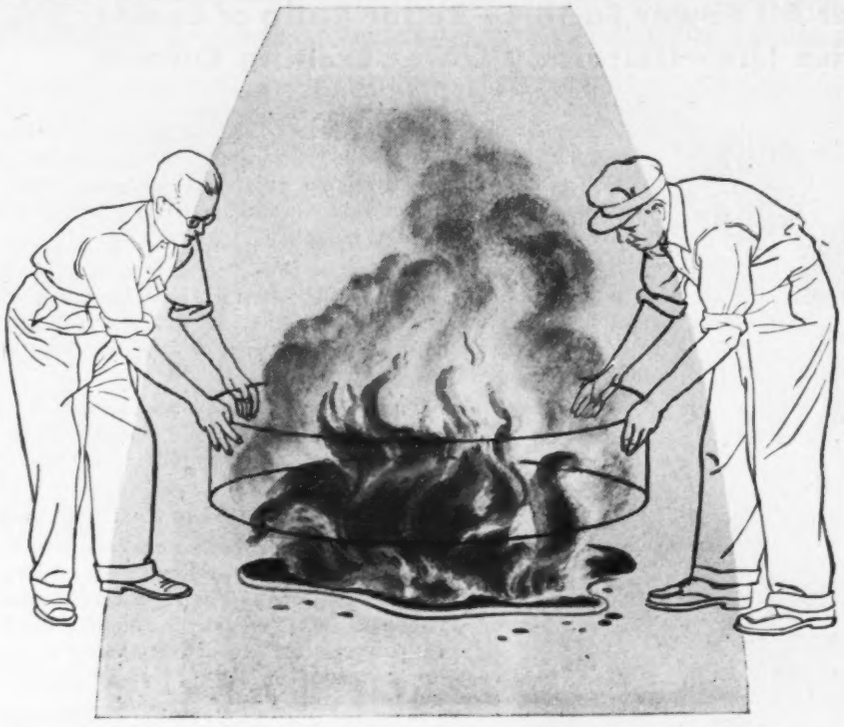
Transformers • Fuse Cutouts • Lightning Arresters • Oil Switches • Pole Line Hardware • Line Construction Specialties • Underground Equipment • Fibre Conduit • Street Lighting Equipment

LINE MATERIAL COMPANY

DISTRIBUTION TRANSFORMERS

It's important to

ISOLATE FIRE



A fire that spreads may bring tragic results—machinery and equipment damaged or destroyed . . . valuable goods ruined . . . precious man-hours lost . . . production at a standstill.

"Automatic" FIRE-FOG is the antidote for fires and fire spread due to ignited oil or other flammable liquids. Its mist-fine water spray *automatically* envelops and "rings" the fire *right at point of origin*. So quickly does FIRE-FOG respond that the fire is blanketed, isolated and quenched, usually in a matter of seconds. Significantly, only the FIRE-FOG Nozzles that "guard" the burning area go into action. For FIRE-FOG concentrates on the fire—no other area is affected.

YOUR KIND OF FIRE! "Automatic's" Proving Ground is a fire-testing laboratory. Here *your* kind of fire hazard is reproduced and the fire protection system best for you is put to test. You *know* before you buy. An "Automatic" Engineer will give you the complete details—no obligation.

"AUTOMATIC" FIRE-FOG

★ IT BLANKETS
★ IT ISOLATES
★ IT QUENCHES

"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA ★ YOUNGSTOWN, OHIO

• • • OFFICES IN PRINCIPAL CITIES • • •

"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA — RATE OF RISE — TRADE MARK REG. U.S. PAT. OFF.

from 15 to 20 cents per sq.ft. of mow area.

The system consists of wooden ducts built on the mow floor through which air is forced by a motor-driven fan. A large main duct, tapering from the fan housing, carries the air to small lateral open-bottom ducts which allow the air to pass up through the hay in the mow. This system is designed to give an even distribution of air over the entire mow floor. Ten cu.ft. or more of air per minute per sq.ft. of mow floor gives best results.

The procedure for handling hay to be cured by the forced-ventilation method takes advantage of the very rapid drying of the hay in the field for the first few hours after it is cut. The hay is cut early in the morning as soon as the dew is off and is allowed to dry for about two hours in the swath. It is then raked into windrows where it dries for another two or three hours. This field drying for four or five hours on a clear day reduces the moisture content from about 75 to 45 percent. At this stage the hay is placed in the barn on the duct system thus preventing damage from rain and dew.

The blower unit is operated continually during the day when humidity conditions are such that the forced air will take moisture from the hay. At night and during rainy days, air is forced through the hay only as needed to prevent heating. This is accomplished by operating the blower unit one hour at six-hour intervals. By this procedure hay can be dried to 20 percent moisture content in 7 to 14 days, depending upon weather conditions and upon the moisture content when placed in the mow.

Records for the 1942 season on 1,005 tons of hay cured by the forced-ventilation method showed that the kilowatt-hours per ton varied from 32 to 96, averaging 53 kwh. per ton for all the systems. Farmers agree that an operating cost of from 75 cents to $1.50 per ton is a small sum to pay for the labor and hay saved, plus the improved quality of hay obtained.

Hay produced by the forced-ventilation method grades consistently one or two grades better than field-cured hay from the same cutting. Ninety and nine-tenths (90.9) percent of the forced-ventilation samples graded U. S. No. 1 and U. S. No. 2, but only 18.7 percent of the field-cured samples graded U. S. No. 2. None of the field cured samples meet the requirements for U. S. No. 1. The hay grading fac-

2 reasons why FLEUR-O-LIER means dependable Fluorescent lighting!

Few users realize the importance of Certified Ballasts and Certified Starters in the operation of fluorescent lighting fixtures. But they are so vital to good fluorescent lamp performance that it's doubly important to get fixtures with "control" equipment you can depend on.

Get the advantages these 2 important auxiliaries offer!

Here, quickly, is what Certified Ballasts and Starters, in the fixtures you specify, mean to you:

- ★ **longer fluorescent lamp life**
- ★ **greater lighting efficiency**
- ★ **full use of your wiring system**
- ★ **DEPENDABLE SERVICE**

CERTIFIED E·T·L SPEC NO.6

That's why about 40 manufacturers of famous FLEUR-O-LIER fixtures use Ballasts and Starters Certified by Electrical Testing Laboratories, Inc., of New York. These parts, like the entire FLEUR-O-LIER fixture, are tested, checked and certified by these impartial experts. They must meet definite specifications for protection of the user and for maximum light from the lamps. Certified Ballasts and Starters can be readily identified by the E. T. L. shield. Look for it when you examine the fixtures you buy or specify.

CERTIFIED E T L SPEC. No.6

You can get industrial and commercial type FLEUR-O-LIER fixtures—embodying Certified Ballasts and Starters—with the necessary WPB priorities. And all equipment meets with government restrictions in the use of critical materials.

FLEUR-O-LIER MANUFACTURERS • 2126-3 KEITH BUILDING • CLEVELAND, OHIO

FLEUR-O-LIER

CERTIFIED FIXTURES FOR FLUORESCENT LIGHTING

Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer who complies with FLEUR-O-LIER requirements

PERMAFLECTOR INDUSTRIAL

DUALIGHTS

DOUBLE THE LIGHT FROM PRESENT OUTLETS

A Perfect Blend of Light

They are doing yeoman service in war plants where "good seeing" is vital; are available on priority only – normal delivery. For general plant illumination, for localized lighting of production lines, assembly benches, inspection tables. They provide light APPROXIMATING THE IDEAL in maximum QUANTITY and optimum QUALITY – give a DAYLIGHT EFFECT.

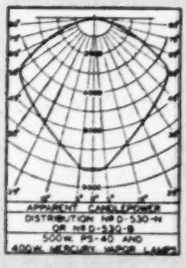
Permaflector DUALIGHTS can be quickly, easily, inexpensively installed – supply over twice as much light without increasing the number of outlets. Each twin-hanger unit is tapped for ¾" conduit stem . . . is equipped with removable plate to simplify wiring . . . with Mogul sockets, safety holders, retaining rings, and appropriate Permaflectors for high or low bay installation.

***No. D-530-N: for Broad Distribution, with No. E-530-GA Permaflectors for 500-watt PS-40 and 400-watt T-16 Mercury Lamps.**

***No. D-505-N: Semi-concentrated distribution, with No. I-505-GO Permaflectors for 500-watt PS-40 and 400-watt T-16 Mercury Lamps.**

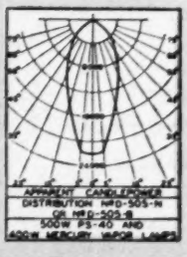
No. D-005-N: Semi-concentrated, with Permaflector No. I-1005-GO and No. I-505-GO for 1000 or 750-watt PS-52 and 400-watt T-16 Mercury Lamps.*

***Also available without retaining ring and strap supports, and at a lower cost as D-530-B, D-505-B and D-005-B.**



PERMAFLECTORS – "shaped mirrors" of silvered glass provide engineered light control for Broad, Medium, or Concentrated Light Distribution.

****400-watt T-16 Mercury Lamp produces 40 lumens per watt – or slightly more light than the 750-watt PS-52 Incandescent – (Light is blue-green in color.)**



Sold thru Electrical Wholesalers

PITTSBURGH REFLECTOR CO.

For Over A Third of A Century — ILLUMINATING ENGINEERS—DESIGNERS AND MANUFACTURERS OF LIGHTING EQUIPMENT—FOR EVERY COMMERCIAL AND INDUSTRIAL LIGHTING SERVICE

OLIVER BUILDING --- --- PITTSBURGH, PA.

★ **WAR BULLETIN** Although practically our entire facilities are devoted to producing special, confidential lighting equipment on prime contract for the Armed Forces, we are supplying our industrial customers on priority and our commercial customers with replacements, when possible, from stock. Startling new developments by our Engineering Department, soon to be announced, promise a better future for the commercial lighting field.

SEE YOUR DISTRIBUTOR OR WRITE FOR COMPLETE DATA ON DUALIGHTS

tors include percent foreign material, percent green color, and percent leaves. The percent foreign material (weeds, etc.) is a factor not influenced by any curing method, the other two factors are definitely favorably influenced by the forced-ventilation method.

•

Inspection Aids Counter Cooker Use

Systematic inspection of commercial electric cooking equipment of the counter type by Boston Edison, followed by local or centralized repairs, restored about 1,000 such appliances to service in eight months. Two men made 1,937 calls on such users, checking up 3,058 appliances aggregating 4,256 kw. in connected load. Minor repairs were made on 931 appliances (1,124 kw. connected) and half of the latter were prevented from going out of service. In addition, 335 appliances (598 kw.) were found out of use, and 95 percent of these were repaired either through outside service agencies or by Edison company representatives. The appliances included bread and sandwich toasters, meat grills, griddles, glass coffee makers, coffee urns, fry kettles, waffle irons, hot plates, fudge, roll and food warmers, water urns and drink mixers.

Minor repairs included replacing cords and plugs, adjusting thermostats and contacts, cleaning, removing grease, etc. Under major repairs were replacement of heating elements, thermostats, internal wiring, switches and condensers on d.c. equipment. The survey yielded valuable data on postwar prospects to be recorded on file cards, besides restoring many appliances whose revenue runs between $30 and $40 per kw. yr. The work was in charge of J. L. Faden of the company's power sales staff.

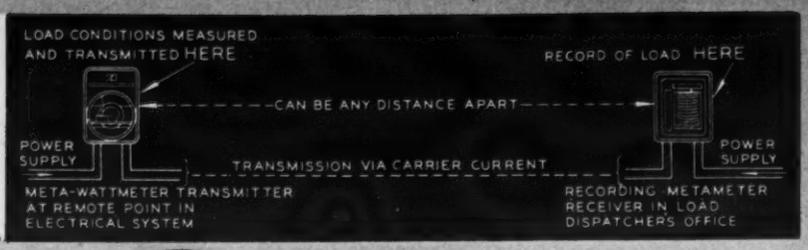
•

Industrial Promotion in Annual Report

In its annual report for 1943 the Cleveland Electric Illuminating Company introduces an innovation in the form of an insert by the company's industrial development division telling of the advantages of Cleveland as an

HOW TO SEE MEASUREMENTS

100 MILES AWAY


LOAD CONDITIONS MEASURED AND TRANSMITTED HERE
RECORD OF LOAD HERE
CAN BE ANY DISTANCE APART
POWER SUPPLY
TRANSMISSION VIA CARRIER CURRENT
POWER SUPPLY
META-WATTMETER TRANSMITTER AT REMOTE POINT IN ELECTRICAL SYSTEM
RECORDING METAMETER RECEIVER IN LOAD DISPATCHERS OFFICE

Without Television . . .

Accurate and continuous information about power exchange over tie-lines and conditions at various load centers — supplied by Bristol Metameters — enables the system dispatcher to keep in closer contact with load changes and so greatly adds to his efficiency.

A PROVED SUCCESS

Pioneered by Bristol, the Metameter system is successfully operated in hundreds of installations.

Best known, perhaps, for its success in carrier-telemetering voltage, current, power, reactive volt amperes and totalized load, it is also being extensively used for telemetering such measurements as pressure, water level, temperature, flow, mechanical motion and gate position.

SIMPLE IN CONSTRUCTION

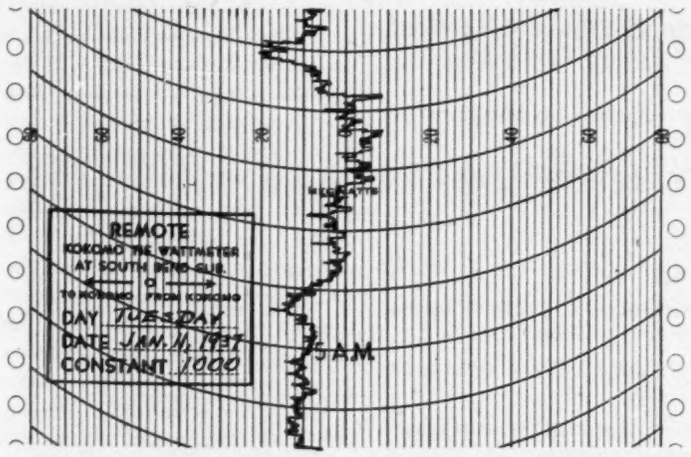
Only 3 units: transmitter, receiver and interconnecting carrier-current channel. So compactly designed are the self-contained transmitter and receiver that their combined weight is less than 40 lbs.

FLEXIBLE IN APPLICATION

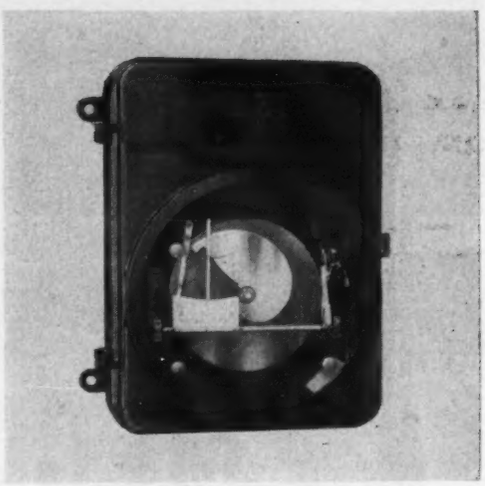
Bristol's Metameter operates on the impulse-duration principle of telemetering. It can be operated over the usual channels available on power systems including either unmodulated or modulated carrier current. A carrier channel, pilot relay channel or any two-wire circuit can be used.

WRITE FOR LITERATURE

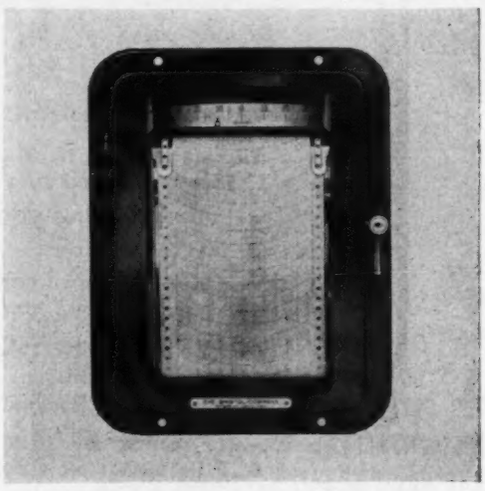
Bristol's Metameter system is described briefly in Bulletin M801 and in complete detail in Bulletin M1700. Either will be sent you on request.



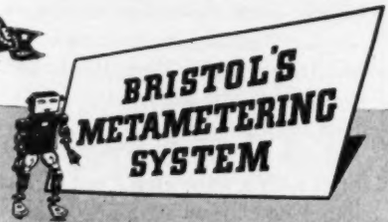
This typical chart recording was transmitted from a tie-line more than 100 miles away by carrier current over a 132 K.V. transmission line.



TRANSMITTER . . . Bristol's Model M40MT Metameter Transmitter



RECEIVER . . . Bristol's Model M28R Strip-Chart Metameter Receiver



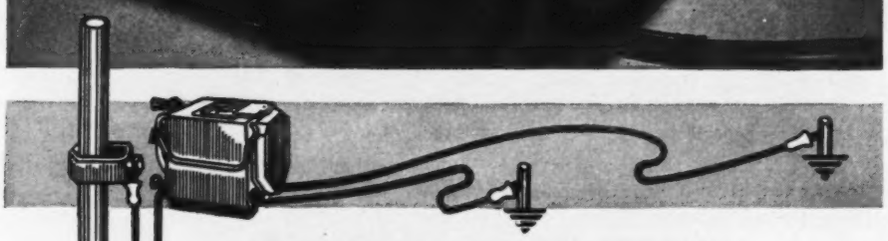
keeps you a jump ahead of demand

THE BRISTOL COMPANY
116 Bristol Road, Waterbury 91, Conn.

The Bristol Co. of Canada, Ltd.
Toronto, Ontario

Bristol's Instrument Co., Ltd.
London N. W. 10, England

MAKERS OF METAMETERS, RECORDING VOLTMETERS, AMMETERS, POTENTIOMETERS, THERMOVERTERS, AND A BROAD LINE OF AUTOMATIC CONTROLLING AND RECORDING INSTRUMENTS



"MEGGER"*

GROUND TESTER

For Measuring Resistance to Earth of Electrical Ground Connections . . .

1. Has its own hand generator; requires no batteries or other external current supply.
2. Direct-reading in ohms—"like a voltmeter."
3. No calculations.
4. Only one set of connections.
5. No adjustments or "balancing."
6. Covers a wide range of resistance—0-3 ohms up to 0-30,000 ohms.
7. Unaffected by the exact resistance of the reference grounds.
8. Unaffected by stray current in the earth—either a.c. or d.c. or by polarization or electrolysis.
9. Self-contained, rugged and portable.
10. Represents only a small fraction of the cost of adequate grounding protection.

As simple, rugged and reliable for ground resistance measurements as are our "Megger" instruments for testing insulation.

FOR SAFETY AND PROTECTION OF LIFE AND EQUIPMENT

**Trade Mark Reg. U. S. Pat. Off.*

Write for illustrated Catalog 1645-W describing all types of "Megger" Ground Testing Instruments.

JAMES G. BIDDLE CO. • 1211-13 ARCH STREET PHILADELPHIA 7, PA.

industrial location. This insert, which can also be used as a separate mailing piece, was placed in the report to elicit the assistance of stockholders in encouraging industries to move to Cleveland. Front and back pages of the insert tell in general terms of the industries in the area while the two inside pages show the company's facilities to provide adequate power, including a map of the system.

•

To Conserve Farm Equipment

In a radio broadcast by F. L. Rimbach, rural service director of the New England Power System, Worcester, Mass., and Miss Dorothy Crandall, a representative small farmer, emphasis was laid upon equipment maintenance points which have proved relatively unfamiliar to many country users of electric service. It appeared in a panel discussion that the importance of periodically oiling appliance motors with the best grade of No. 20 automobile oil was not realized, Mr. Rimbach pointing out that at least 50 percent of motor failures arise from this cause. It was brought out that motors in dusty places, in barns and electric brooders require extra attention as to dusting out. Adequate wiring was also unfamiliar to many farmers, Mr. Rimbach asserted, and the use of time delay fuses with thermal cutouts instead of straight fuses for motor protection opened a new outlook on electrical maintenance. Not less than No. 10 wire was advised for a ¼ or ⅓-hp. motor. Attention was called to a bulletin of the U. S. Department of Agriculture on the care of motors, containing a recommendation on behalf of time-delay fuses to assist in keeping farm appliance motors in operation for the duration.

During the broadcast it was brought out that homemade water warmers and brooders can be assembled with little difficulty and at low cost. The former were described as simple arrangements of weatherproof sockets and lamps, imbedding the lamp in a watertight can using dry sand as a filler. A brooder for 25 chicks could be made by using a 60- or 100-watt lamp with a wire guard put in a cardboard carton or small wooden box, expanding this design to serve 300 chicks if required.

(Here's another ad in the series that brings a vital message to your customers.)

In postwar planning...

HOW is just as important as WHAT

NO MANUFACTURER can predict all the new products he will make in the next decade. But he does know that new and improved methods of *producing* them are already here—methods calling for increased use of electric power.

That's why far-seeing management is attaching such importance to *adequate wiring* . . . seeing that it's a basic part of all postwar planning. They realize that tomorrow's competitive position will depend more than ever on electric energy . . . *and adequate wiring to harness it.*

Right now is the time to find out how *your* plant's wiring system measures up . . . what it needs to meet postwar requirements. By all means, bring your electrical contractor and utility power engineer into the advance planning stage. *Unwired* planning will cost you a lot more than *planned wiring.*

44224

HELP BRING VICTORY SOONER . . . BUY MORE WAR BONDS

ANACONDA WIRE & CABLE COMPANY

25 Broadway, New York 4 . . . Sales Offices in Principal Cities

Electrical Wires and Cables of Copper are the Life Lines of our Nation

A NEW Westinghouse

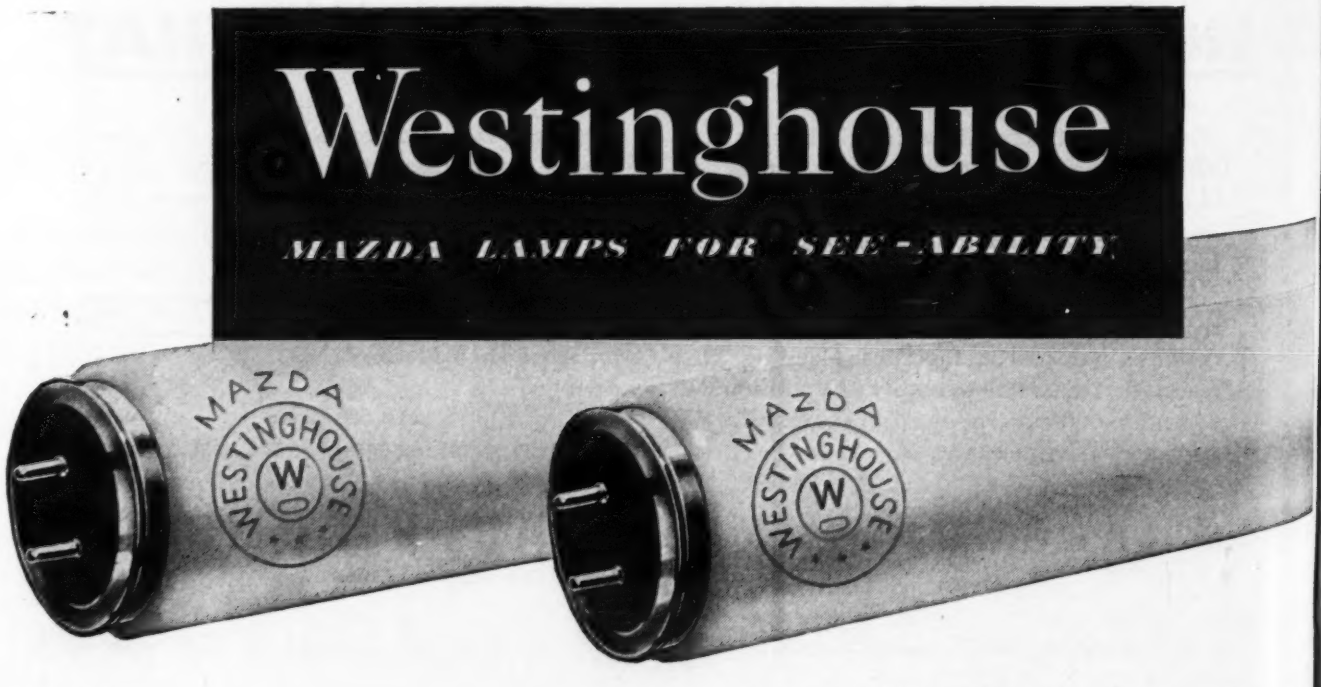
The increased use of instant starting ballasts for 40 watt lamps has developed the need for a lamp which will operate satisfactorily on such ballasts. Westinghouse engineers have now perfected a lamp for this purpose.

This new 40 watt white Westinghouse Mazda Fluorescent lamp will have the same rated life when operated on the instant starting ballast that the standard 40 watt Westinghouse Mazda Fluorescent lamp now has when used with conventional ballasts and starters.

It should be ordered only for use on the instant starting ballast and should not be ordered for use in installations having preheat starting. It will be specially marked and will have the same list price as the standard lamp. Limited quantities of these lamps will be available for shipment on and after May 1, 1944.

New developments such as this typify the skill and resourcefulness of Westinghouse engineers. Based on a persistent policy of product improvement, they are the reason why the name "Westinghouse" has come to mean leadership in lighting.

They are the reason, too, why it pays to recommend Westinghouse Mazda Lamps for every lighting application and installation. Westinghouse Elec. & Mfg. Co., Bloomfield, N. J. *Plants in 25 cities . . . offices everywhere.*



FLUORESCENT LAMP

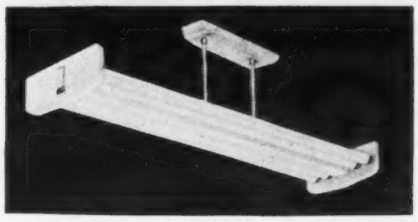
FOR INSTANTANEOUS STARTING CIRCUITS

LET'S ALL KEEP BACKING THE ATTACK... BUY MORE WAR BONDS

NEW EQUIPMENT

Fluorescent Fixture

Designed for use in offices, drafting rooms and other work areas, new fluorescent fixture offers several methods of hanging—suspension mounting, surface mounting, individually, or in continuous rows. Metal tracks, furnished with unit, are fastened to ceiling with toggle bolts or Ackerman; fixture slides into place on tracks. All-metal wireway channel and end pieces, finished in high-gloss, chip-proof white enamel.



"Model 2044" commercial fluorescent fixture; uses four 40-watt lamps; operating voltage 110-125 v., 60 cycles, a.c.; higher voltages available. **Mitchell Mfg. Co.**, 2525 Clybourn Ave., Chicago 14, Ill.

•

Bushing Cement

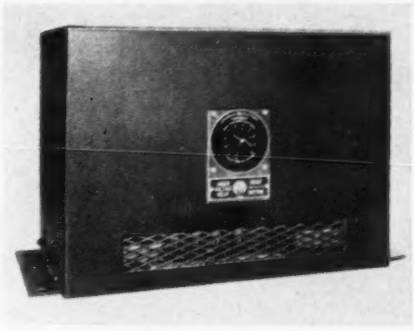
Type "16-A" bushing cement: melting point 265 deg.; pouring temperature 400 deg. F.; **John C. Dolph Co.**, Department 20, 168 Emmett Street, Newark 5, N. J.

A bushing cement has been developed for sealing bushings, cable joints, boxes and instruments. It is said to be hard, non-caking, oil and water proof, to adhere to metal and porcelain, and to have a low coefficient of contraction.

•

Welding Control

Applicable for low-capacity spot welders, control unit when coupled with suitable transformer can be used with either welding tongs or a small bench welder. Two FG-172 tubes control primary current of welding transformer and FG-97 tube controls the firing time. A calibrated time adjustment on front of panel provides either one-half cycle or any number of complete cycles from one to ten. The enclosed unit can be mounted on top or underneath the assembly bench.

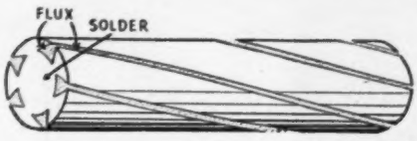


"CR7503" thyratron spot-welding control; rated 53 amp. rms, 230 and 460 volts, 50/60 cycles. **General Electric Co.**, Industrial Control Division, Schenectady, N. Y.

•

Solder

Wire solder contains flux in longitudinal grooves on the surface. By this arrangement the flux is stated to liquefy and flow onto the work before the solder melts and in addition to provide a continuous flow at all times.



"Fluxrite" fluxed wire solder; same diameter as cored solder; designations Red Stripe and Green Stripe refer to color of flux for identification. **National Lead Co.**, 111 Broadway, New York 6, N. Y.

•

Insulation

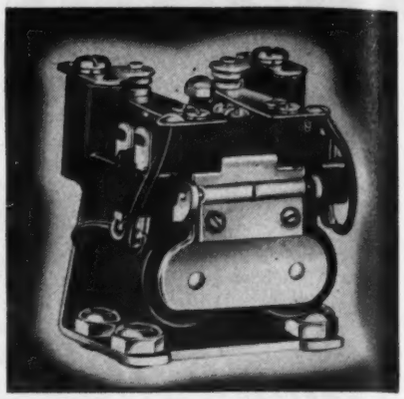
Polythene plastic; white translucent; dielectric strength, step by step, 1,000 v.p.m.; power factor, 60 and 10^6 cycles, less than 0.0005. Plastics Department, **E. I. du Pont de Nemours & Co., Inc.**, Wilmington, Del.

New plastic, manufactured by the polymerization of ethylene is stated to be adaptable for insulation of wires and cables, waterproof coatings, piping and gaskets. It can be extruded, injection molded, compression molded and calendered. In sheet, rod or tube form it can be machined, cut, blown, blanked or swaged. Some other properties are reported to be: tensile strength at —70, 77 and 170 deg. F., 5,000 1700 and 700 psi; flexural strength at 77 deg. F., 1700 psi; resistant to water, alkalies, acids and oxygenated solvents. At present it is available in powder form and in pound lots.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Relay

Suitable for plate circuit applications relay has two coils which may be connected in series for operation at one voltage or in parallel for a second voltage, or one coil can be used for operation while the other is used for holding. The semi-balanced armature construction is said to withstand vibration equivalent to 10 G.



Model "BOY" dual coil relay; power requirement 0.5 watt; double contacts. **Allied Control Co., Inc.**, 2 East End Ave., New York 21, N. Y.

•

Resistors

"Meg-O-Max" resistors: type "1", 5 9/32 in. long, range from 3,600 ohms to 100 megohms; type "2", 9 25/32 in. long, range from 6,800 ohms to 100 megohms. Resistor Division, **Sprague Specialties Co.**, North Adams, Mass.

Resistors are formed of a series of pressed and sintered ring-shape segments electrically joined in such a way as to cause the units to be non-inductive. Finished units are encased in an hermetically sealed, rugged glass envelope provided with ferrule terminals. They can be employed as high-voltage bleeders as well as in measuring equipment, rectifier systems, high-voltage dividers and as broad accuracy meter multipliers.

•

Fire Extinguisher

Wheeled-type extinguisher has 100 lb. of compressed carbon dioxide. Shielded nozzle is equipped with a long handle-grip and a

"Model 100" wheeled fire extinguisher. **Walter Kidde & Company, Inc.**, Belleville, N. J.

A Case of Identity

REQUISITES FOR LIGHTNING ARRESTERS

1. High Protective Level
2. Ability to Carry Heavy Surge Current
3. Good for Both Long and Short Wave
4. No Breakdown on Normal Current
5. Moisture Proof *
6. Operate in All Climates
7. Long Life
8. Field and Laboratory Success
9. Ability to Prevent Line Lock-out
10. Operating Characteristics Unchanged Over Long Service

The men illustrated above are three Electrical Engineers and a Purchasing Agent. These men collaborated in preparing the list of "Requisites for Lightning Arresters" shown at the left. The list was recently published and distributed by a leading Electrical Trade Paper.

* No. 5 was unanimously voted most important.

OPERATING MEN ASK FOR IT!
HUBBARD AUTOGAPS HAVE IT!*

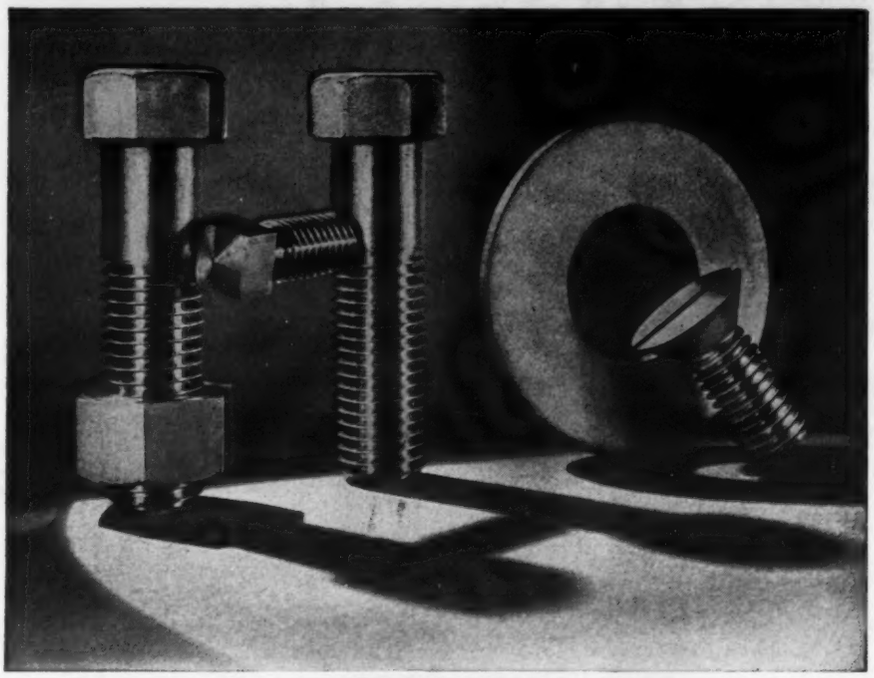
Hubbard Autogaps Have the Answers

1. Yes! Rapid operation — characteristics are fixed. Breakdown point 55% of insulation strength of equipment.
2. Excellent! In excess of 65,000 Amperes of surge current without failure.
3. Yes! Handles Long and Short Waves with equal ability.
4. No! Gap settings are above possible 60 cycle voltages.
5. Better than moisture proof. Design characteristics for Expulsion Type Arrester not affected by moisture.
6. Yes! High and low altitudes — high and low temperatures have not affected good performance.
7. Yes! Made entirely of time-tested, durable material — virtually unaffected by each operation.
8. Excellent laboratory performance confirmed by several years field experience.
9. Yes! Multiple gaps in series containing *no fusible material.*
10. Field experience proves unchanging values over long period of service. Oscillograms are available.

In other words . . . these four men might well have written a single word on their list . . . "Autogaps"

HUBBARD AND COMPANY

PITTSBURGH .. OAKLAND CALIFORNIA CHICAGO



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HEADQUARTERS is "a chief place of business." So . . . when you need non-ferrous and stainless fastenings, come to Harpers . . . the organization which specializes on the manufacture of bolts, nuts, screws, washers, rivets and specials made of Brass, Bronze, Copper, Everdur, Monel and Stainless . . . an organization not concerned with common steel fastenings.

To serve fastening users, Harper stocks over 4280 different items . . . employs a large staff of engineers and field service men . . . and offers a vast fund of practical non-ferrous and stainless fastening "Know how." Sample this "Know how" by writing (on your letterhead) for a 4-color, 84 page catalog.

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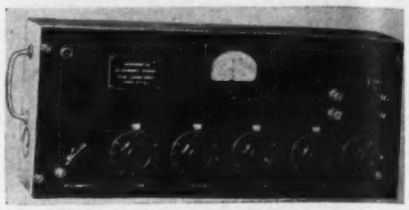
shunt-off valve which is said to permit conservation of gas during changes of fire-fighting position. Unit bears Underwriters' Laboratory B and C rating as suitable for flammable liquid and electrical fires.

•

Resistance Meter

An electronic instrument, basically an a.c. bridge, measures resistances as ohms and impedances by comparison, changes as low



Type "G-710" microhmmeter: measures from 0.0001 ohm to 1 megohm. **Tech Laboratories**, 7 Lincoln St., Jersey City 7, N. J.

as 0.01 percent are readily indicated, it is claimed. Readings are taken from a decade and a meter is used as a null indicator. Contact resistance can be measured in relays, switches, joints and bondings.

•

Indicating Light

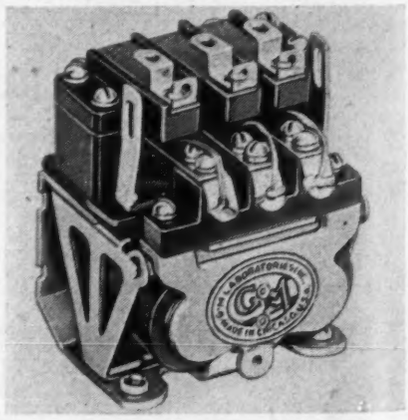
In a new lamp receptacle for either panel or switchplate mounting, the bulb is recessed into the unit from the front of the panel so that the tip of the lamp exposed assumes the appearance of a lense. Exterior ventilation to the bulb is expected to provide greater lamp-life.

Type "S-11" pilot light: accommodates standard 10-watt, S 11 lamp bulb. **The H. R. Kirkland Co.**, Morristown, N. J.

•

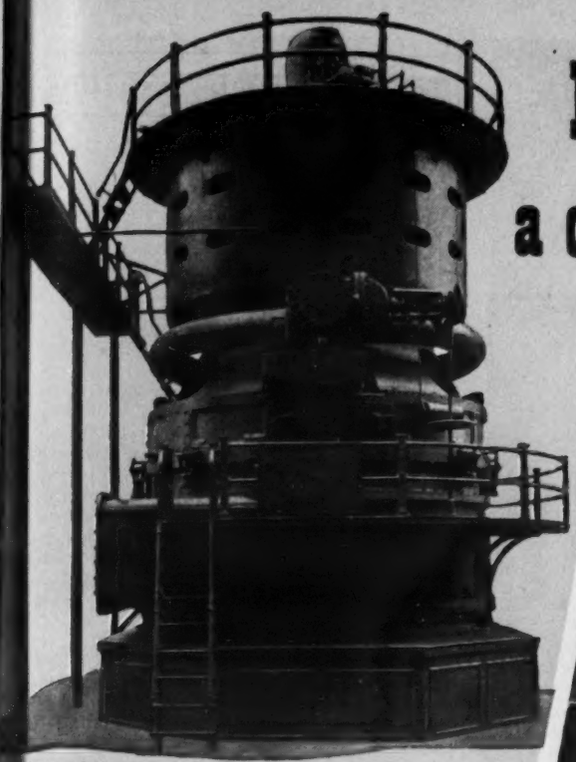
Relays

Small multi-pole relays suitable for electronic circuits have been designed for use where vibration is encountered, such as for vibration and acceleration conditions of 10 G. Contact pressure is 30 to 50 grams.



"Type 27" sensitive relays: 1 to 5 poles; contact capacity, up to 10 amp.; weight 4½-6½ oz. **G-M Laboratories, Inc.**, 4326 North Knox Ave., Chicago, Ill.

In 1903
a one-job oil was good enough...



(Above)
A granddaddy of the modern steam turbine. This 5,000 KW turbine-generator set of 1903 vintage operated at low steam temperatures and pressures . . . required no specially refined oil.

(Right)
Today's speedy, high-temperature turbines need an oil especially refined for turbine operation . . . an oil that prevents rust, and at the same time has superior oxidation stability.

BUT TODAY'S TURBINES NEED THIS 2-JOB TURBINE OIL!

1—That Prevents Rust
2—That has Superior Oxidation Stability

A GENERAL-PURPOSE lubricating oil was plenty good enough for those lumbering, old giants of yesterday.

But to withstand the severe conditions encountered in modern turbine operation, an oil must do 2 jobs at once: (1) *prevent rust*, (2) *resist oxidation*. It is this ability to do both jobs at once, to an unusual degree, that has built up for Shell Turbo Oil an enviable reputation for outstanding performance in every type of steam turbine operation.

For over a year, Shell Turbine Oil has been used aboard battleships, destroyers, aircraft carriers and other units of our fleets, under operating conditions far more severe than any met on land. In fact, Shell Turbine Oil was the first of its type to be approved as meeting rigid U. S. Navy specifications.

With performance records like this no turbine operator can afford to ignore the possibility of using Shell Turbo Oil in his turbines. Call in the Shell man now.

Or, if there is not a Shell office near you, write: Shell Oil Company, Inc., 50 West 50th Street, New York 20, N. Y., or 100 Bush Street, San Francisco 6, California.

SHELL

SHELL TURBO OIL

Designed to Outlast the Substation

HI-VOLTAGE

Type CW Air Break Switches

● Designed electrically and mechanically to provide more than just efficient performance—actually built to give life beyond the age of the substation. This Hi-Voltage CW Switch is attractive in appearance, involves low installation cost, offers ease of operation and unmatched dependability . . .

Closing—the switch arm swings to the horizontal position in alignment with the contact—moves endways through opening of contact housing into contact.

It is essential that a switch mechanism develops its most powerful leverages at the open and closed positions. Hi-Voltage accomplishes this with a completely housed linkage which controls the motion of the switch arm.

HI-VOLTAGE

EQUIPMENT COMPANY

2891 E. 79th St. • • • • • CLEVELAND, OHIO

TECHNICAL LITERATURE

POLYTHENE—Typical properties and a description of polythene, a thermoplastic which can be molded or extruded, are contained in "Plastics Bulletin," Vol. 6, 1944, issued by Pastics Department, E. I. duPont de Nemours & Co., Arlington, N. J.

STEAM TURBINES—A reference manual, "Single-Stage and Multi-Stage Mechanical Drive Steam Turbines," deals with subjects such as basis of ratings, pressure and temperature standards, turbine load capacities, overspeed protective devices, relief valves for turbine discharge connections, and speed governed by external devices. This twelve-page manual (Recommended Standards) should prove useful to users, consulting engineers and manufacturers. It is Publication No. 43-88 issued by National Electrical Manufacturers Association, 155 East 44th St., New York 17, N. Y.; price 50 cents per copy.

FEED WATER CONTROL—"Mechanical Feed Water Regulation for Boilers," 6th edition, covers the principles of boiler feed water control and describes mechanical equipment to meet various operating conditions. Differential pressure control and feed pump control are also discussed. Numerous illustrations, diagrams and chart reproductions are included in this publication obtainable from Northern Equipment Co., 1945 Grove Drive, Erie, Pa.

CHAIN DRIVES—A series of tables has been computed to shorten the time required for calculating center distances and chain lengths of chain drives operating over cut-tooth wheels. They are published in book 1991, available from Link-Belt Co., 307 N. Michigan Ave., Chicago, Ill., or other offices of the company.

GLOSSARY—"Chemical Names and Terms Frequently Encountered in the Synthetic Rubber Industry" contains pronunciations and meanings of the more common chemical terms and some of the well-established trade names. The 8-page pamphlet may be obtained from Hycar Chemical Co., 335 South Main St., Akron, Ohio.

VALVES—A selection chart has a breakdown of conditions to consider when selecting valves and an explanation of what the conditions determine in the operation of a valve. An additional feature is the explanation below the breakdown and also an example which uses the facts brought out in the chart. Copies of the 11½ x 17-in. cardboard chart are available from Reading-Pratt & Cady Division of American Chain & Cable Co., Inc., Dept. S.P., Bridgeport, Conn.

V-BELT DRIVES—A 44-page bulletin contains engineering data for fractional hp. Texrope V-belts and sheaves. Hp. ratings are based on driven revolutions per minute and on belt velocity. Also included are working formulas from which fractional hp. drives can easily be derived, as well as line drawings and selection tables. Bulletin B-6249 is made available by Allis-Chalmers Mfg Co., Milwaukee 1, Wis.

INCLOSED POWER DUCTS—For resistance-welder installations, graphs for capacity and voltage drop, a method of selecting size of inclosed ducts, and an illustrated typical welder-distribution system, also data on feeder and plug-in duct equipment are included in Bulletin 6000 issued by Square D Company, 6060 Rivard St., Detroit 11, Mich.

This BullDog Vacu-Break Switchboard controls blower operation. Note space for additional circuits.
Three BullDog Vacu-Break Switches are used in connection with the heat treatment of aircraft rivets.

PAN AMERICAN CHOSE *Vacu-Break*

BullDog Switches and Switchboards Control Light and Power Throughout New Million-Dollar Miami Hangar

Constructed as a unit, the new Miami building illustrated above, includes three four-story shop and office buildings divided by two hangars.

Largest and costliest of all structures in the far-flung Pan American World Airways System is this giant maintenance and office building — a monument to U. S. leadership in the skies.

That BullDog electrical equipment is used to control light and power throughout this giant aircraft center is a tribute of which we are proud.

Choice of switches, switchboards, panelboards for such great installations is not lightly made. Decisions are based on superior design, greater safety and dependability, longer life and lower upkeep cost.

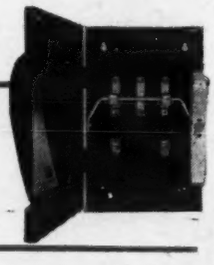
BullDog meets these requirements squarely and completely — with the famous Vacu-Break principle which assures the most positive action, maximum safety and minimum wear.

Whatever the electrical problems of your plant or offices, BullDog engineers can contribute to the results you want. Write today for a descriptive booklet giving full information.

BULLDOG
ELECTRIC PRODUCTS CO.

BOX 177, R. PK. ANNEX
DETROIT 32, MICHIGAN
BullDog Electric Products of Canada, Ltd., Toronto, Ont.

Field Engineering Offices in All Principal Cities



In addition to Vacu-Break Safety Switches, BullDog Electric Products Company manufactures a wide variety of products for power distribution and control, including SafToFuse Panelboards, Circuit Master Breakers, Switchboards and the three famous Bus Duct Systems — BUStribution DUCT, *for "plug-in" power,* Universal Trol-E-Duct, *for flexible lighting,* and Industrial Trol-E-Duct, *for movable "loads."*

"We're in the Picture" —says *Romey

Here's a glimpse down one corridor of our bare wire mill.

We have adequate capacity for solid and stranded conductors in bare and weatherproof.

Send us your orders now.

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	DETROIT 2, MICH.

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FROM BAR TO FINISHED WIRE

ROME CABLE CORPORATION

ROME • NEW YORK

NEWS ABOUT PEOPLE

L-M Subsidiary Makes New Appointments

Line Material Co., Milwaukee, has announced several changes in the management of L-M subsidiary at East Stroudsburg, Pa.

Williams L. Owens, general superintendent and secretary of Line Material Co. of Pa. was elected vice-president and general manager. Clarence W. Rubow, treasurer and director of purchases, has assumed in addition the position of assistant general manager. R. P. Balmer, chief accountant of Line Material Co. of Pa., was made secretary.

•

▶ FRANK J. MEISTRELL, secretary of the Union Electric Co. of Missouri since 1940, has resigned to become associated with the New York law firm of Donovan, Leisure, Newton & Lumbard, with which he was formerly connected. Mr. Meistrell is a graduate of Princeton University and received a law degree from Harvard. EUGENE SHAPIRO, assistant secretary, has been named acting secretary of the company.

▶ M. C. HANCOCK, a veteran of 34 years with the Washington Gas & Electric Co., has been appointed superintendent of the company's distribution system in Tacoma to succeed the late Joseph H. Harris. Prior to his appointment to the Tacoma position, Mr. Hancock had been manager of the company's Gray Harbor branch.

▶ JOHN M. SALLING, Underwriters' Laboratories, Chicago, has recently returned to his former duties as assistant superintendent of label service. Since 1942 Mr. Salling has served as senior industrial specialist in the fire equipment section of the safety and technical equipment division of WPB, Washington, D. C.

▶ MORTON E. YOHALEM has been appointed counsel to the public utilities division of the Securities and Exchange Commission to succeed ROGER S. FOSTER, recently made solicitor of the commission. Mr. Yohalem joined the SEC in 1938, serving first as an attorney on corporation reorganizations under Chapter X of the Bankruptcy Act and more recently as special counsel in the office of counsel to the public utilities division.

•

L. L. Perry Heads Post-War Planning Committee

To help utilities in Iowa provide additional employment in the post-war era, the Iowa Utilities Association has recently formed a post-war planning committee headed by L. L. Perry of the Interstate Power Co. and assisted by co-

chairman G. V. Lonnecker of Iowa Public Service Co. and H. D. Makeever, Peoples' Gas & Electric Co.

The full committee of 25 met at Des Moines, Iowa, recently and decided to hold a two-day post-war sales conference at Des Moines on June 19-20. Program plans will be announced later.

Other members of the committee are: R. Ingham and M. L. Nolan of Central States Electric Co.; E. G. Nichols, J. P. Walters and H. G. Mead of Iowa Electric Light & Power; E. F. Miller and J. M. Hollingsworth of Iowa-Illinois Gas & Electric; J. Schilling, J. F. McLaughlin and H. Reeves of Iowa Power & Light Co.; D. Raymond, V. Myers and C. A. Nordstrom of Iowa Public Service Co.; G. T. Perrine and V. C. Price of Iowa Southern Utilities Co.; E. M. Ruede of Nebraska Power Co.; L. G. Johns, Central States Power & Light Co.; M. A. Harpster and H. J. Reiber of Peoples' Gas & Electric Co.; P. Naney and C. A. Hummel, Interstate Power Co.; and W. R. Blake of Iowa Utilities Association.

•

New Officers Elected By General Radio Co.

Melville Eastham has retired from the presidency of General Radio Co., Cambridge, Mass., but will continue as a director and for the present will carry on his responsibilities in charge of research and development with the title of chief engineer. Harold B. Richmond, a continuing director, has been elected chairman of the board and of the company's management committee.

Errol H. Locke, a director and formerly vice-president, has been elected president. Frank L. Tucker, a new director and formerly comptroller, has been elected treasurer and secretary. Henry S. Shaw, formerly chairman, will continue as a director. Arthur E. Thiessen, formerly commercial engineering manager, has been named vice-president in charge of sales, and Charles C. Carey, formerly superintendent, has been made vice-president in charge of manufacturing.

•

▶ H. H. PEARSON has been appointed industrial power representative of the southeast division of the Alabama Power Co. on a full time basis. This work was formerly handled by the division superintendent in connection with his other duties. Mr. Pearson was formerly meter superintendent of the southeast division. He joined Alabama Power in 1925.

▶ WILLIAM M. HICKEY has been elected a director of the Niagara Hudson Power Corp. Mr. Hickey is president and a director of the United Corp.

▶ W. P. SHAFFER has been appointed district manager of the Southern California Edison Co., at Pasadena, succeeding C. M. Campbell, who will be Santa Monica district manager.

▶ JOSEPH W. BARKER, dean of Columbia University's School of Engineering, received an honorary doctorate of laws at the commencement exercises of Union College, Schenectady, N. Y.

▶ DORSEY R. SMITH, manager of merchandising and domestic gas and electric sales of the Consolidated Gas, Electric

SQUEEZ-GRIP *has them covered!*

The swift release of carbon dioxide against sudden fires is so simple with the sensationally new SQUEEZ-GRIP valve that women workers can operate it easily and effectively. With this modern C-O-TWO release valve anyone using it merely closes his hand to operate the release lever, just above the carrying handle, and carbon dioxide, the fastest non-damaging fire extinguishing agent, knocks out a fire in split seconds. Even while carrying a 15 pound extinguisher—no need to set the cylinder down to operate it—C-O-TWO gas can be discharged or stopped as quickly as you can close or open your hand. Time is saved . . . gas is saved . . . property is saved. SQUEEZ-GRIP is Safer—It's Faster.

TRADE C-O-TWO MARK

C-O-TWO FIRE EQUIPMENT COMPANY

NEWARK 1, NEW JERSEY

Sales and Service in the Principal Cities of United States and Canada

Light & Power Co., Baltimore, Md., has retired after 40 years of service. He has been succeeded by CHESTER S. STACKPOLE, who has been assistant manager since 1928.

•

Allis-Chalmers Reports Changes in Personnel

Announcement has been made by the Allis-Chalmers Manufacturers Co. of the appointment of James H. Pestalozzi as regional engineer with headquarters in San Francisco. For several years Mr. Pestalozzi has been working on the company's marine developments, specializing in main drive and generating equipment. His new duties will be supervision of engineering procedure in nine western states.

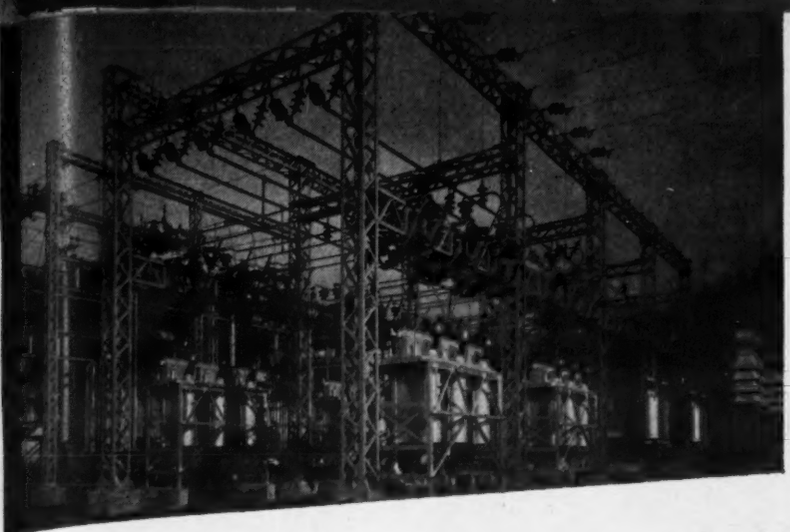
C. T. Hurd will be northwestern central station specialist, with temporary headquarters in Seattle. His territory will include the state of Oregon, Washington and Montana.

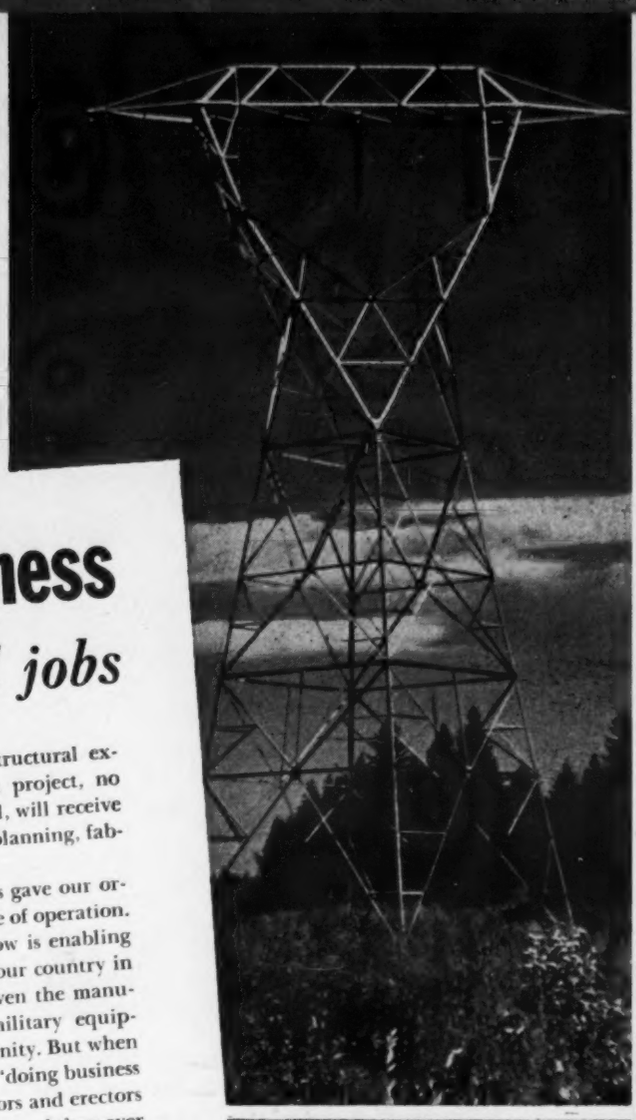
•

► WILLIAM F. FRISCH has been appointed superintendent of the lightning arrester, cutout and load ratio control sections and HUGH R. MCKEAN, superintendent of the capacitor section, in the manufacturing division of the Pittsfield (Mass.) Works of General Electric. Mr. Frisch was formerly connected with the company's Fort Wayne (Ind.) Works, and has been at Pittsfield since 1927. Mr. McKean became a student test engineer at Pittsfield in 1923, spent 16 years at the Schenectady Works and then returned to Pittsfield as operating manager of the local division of the plastics department. In 1942 he was transferred to special assignments in the general superintendent's office. Ralph L. Hatch will serve as assistant superintendent under Mr. Frisch and Alpheus C. Bemis in a similar post under Mr. McKean.

► FRANK M. TAIT, president of the Dayton Power & Light Co., Dayton, Ohio, is celebrating his fortieth year with that utility. The company's employee publication, "Forward," observed the occasion by dedicating the February 29 issue to Mr. Tait.

► WILLIAM C. PIRIE, formerly assistant sales promotion manager, has been appointed assistant advertising manager in the office of John P. Waters, manager of lighting division advertising of Sylvania Electric Products, Inc., in New York. JOHN B. STEVENSON, formerly in the Boston sales office, is the new assistant advertising manager in the same di-





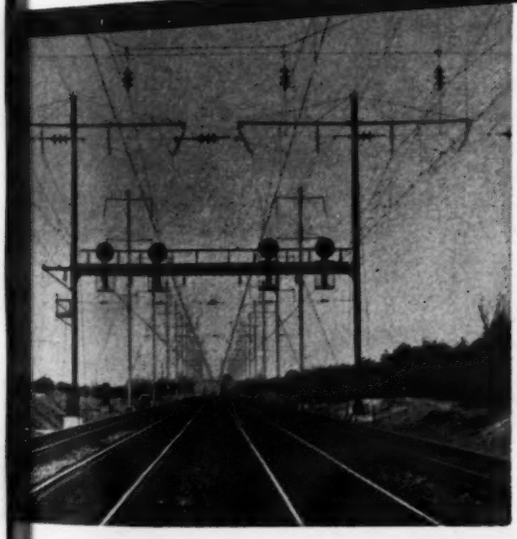
Engineering Resourcefulness

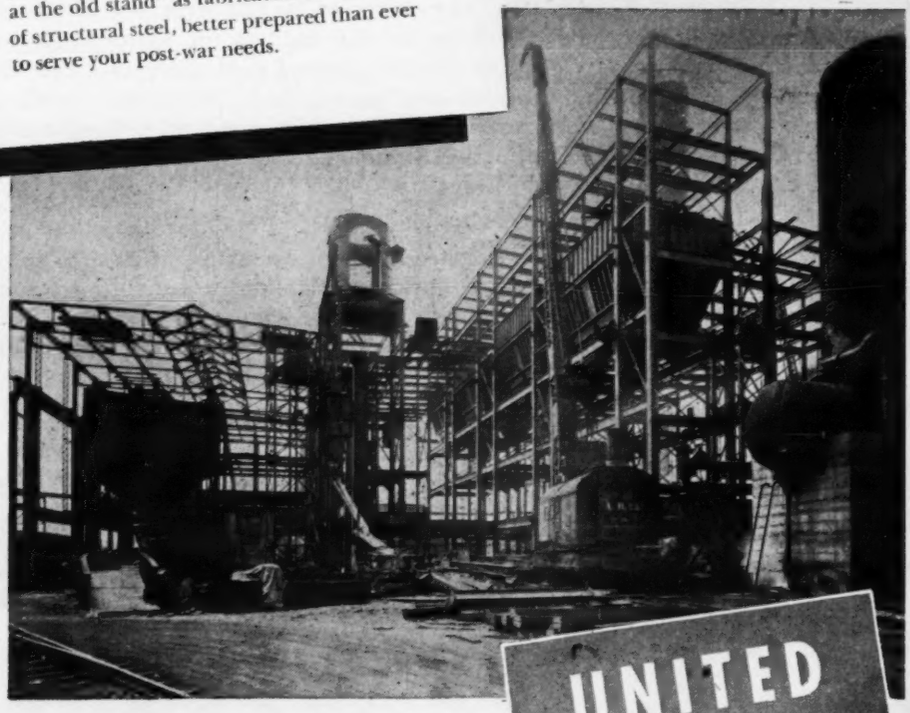
—a "plus" for your structural jobs

DURING the many years we have fabricated and erected steel structures for the electric power industry, one characteristic of American Bridge service has had more to do with the success of the jobs we have handled than anything else. It isn't a tangible factor. We can't write it into contracts. But every project benefits from it. You may have heard it called *engineering resourcefulness.*

What is this quality worth to you? . . . It means that every job American Bridge undertakes—whether it is the steelwork for a generating station, the towers for a transmission line, a substation structure, or an electrification project—will profit from an unsurpassed background of structural experience. It means that each project, no matter how large or how small, will receive the same painstaking care in planning, fabrication and construction.

Engineering resourcefulness gave our organization its worldwide scope of operation. This same resourcefulness now is enabling us to serve the war needs of our country in numerous ways, including even the manufacture of high-precision military equipment. We value this opportunity. But when peace returns, you'll find us "doing business at the old stand" as fabricators and erectors of structural steel, better prepared than ever to serve your post-war needs.





AMERICAN BRIDGE COMPANY

General Offices, Frick Building, Pittsburgh, Pa.

District Offices in: Baltimore · Boston · Chicago · Cincinnati · Cleveland
Denver · Detroit · Duluth · Minneapolis · New York · Philadelphia · St. Louis

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
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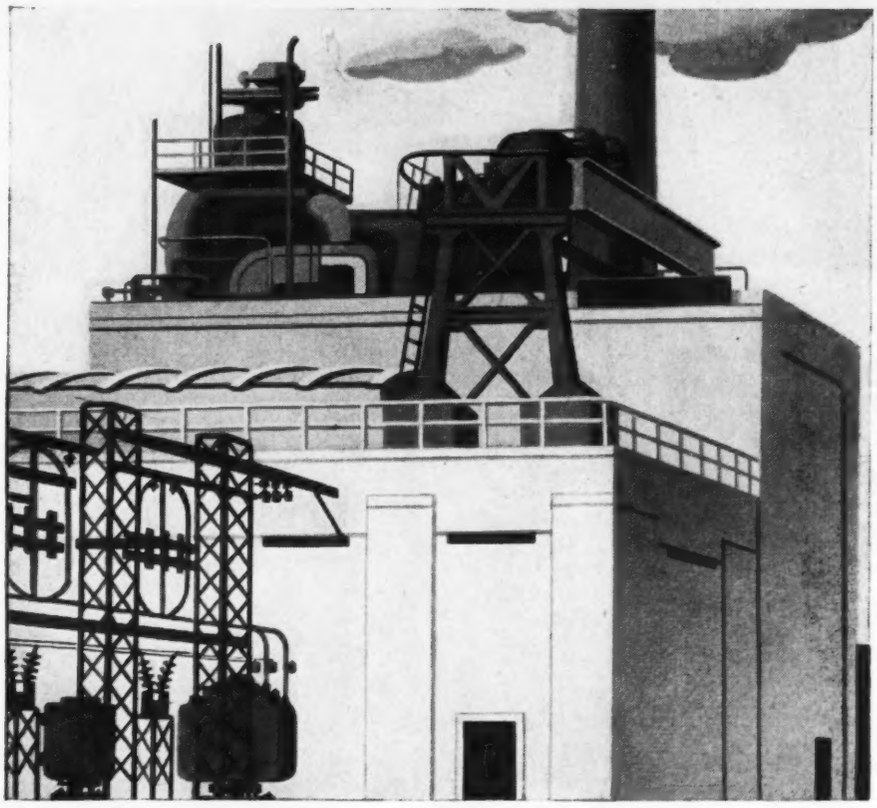
USS UNITED STATES STEEL

CABLE PROTECTION . . .

Vital Factor in Sound Postwar Planning



Plans for postwar construction — *to be truly constructive* — must take into account three important factors regarding electrical service.

First, revolutionary changes prophesied for tomorrow will emphasize American industry's dependence on the utilities for light, power and communications service. *Second,* the assured continuity of these vital services will demand *complete* and *lasting* cable protection. *Third,* tomorrow as today, such protection will be best provided *underground*— in Orangeburg Fibre Conduits — *Standard* for main lines — *Nocrete* for feeders, laterals.

IMPORTANT ORANGEBURG FEATURES:

Non-metallic—does not corrode. *Impermeable*—no leaks, no infiltration of ground moisture (acid or alkaline). *Ample mechanical strength* resists breakage. *Smooth bore* does not score or damage cable sheath. *Tight joints* quickly made. *Light weight* means easier handling. Assembles and installs faster. Write for literature today!

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ORANGEBURG FIBRE CONDUIT

THE FIBRE CONDUIT CO. ORANGEBURG N.Y.

ORANGEBURG

WITH 50 YEARS EXPERIENCE IN THE MANUFACTURE OF NON-METALLIC CONDUIT AND PIPE, SERVES THE POWER AND LIGHT, TELEPHONE, GENERAL CONSTRUCTION, CHEMICAL, PETROLEUM, PLUMBING AND BUILDING SUPPLY FIELDS WITH ELECTRICAL FIBRE CONDUIT . . . ELECTRICAL UNDERFLOOR DUCT SYSTEMS . . . AND FIBRE PIPE FOR NON-PRESSURE USES.

vision, in charge of the advertising office at Salem, Mass. He succeeds JAMES R. DUFFY, who has become manager of employee activities in the company's industrial relations department. A native of Nahant, Mass., and a graduate of Boston University, Mr. Pirie was advertising manager of the Lynn (Mass.) Gas & Electric Co. for eight years and later advertising manager of appliances for the Waring Corp. before joining the Sylvania sales department in 1941. Mr. Stevenson was associated with Westinghouse before he joined Sylvania.

•

Pacific Electric Motor Elects New Officers

Changes in management owing to the recent death of its president, Walter D. Vance, have been announced by the Pacific Electric Motor Co., Oakland, Calif. Frank E. Boyd, partner of Mr. Vance, becomes president. Mrs. Lina K. Vance, widow of Mr. Vance, will be vice-president and W. D. Vance, Jr., secretary-treasurer. G. R. Duncan has been made executive engineer in charge of engineering and sales.

•

▶ J. PAUL OLIVER has been appointed administrative technical assistant of the research division of the Cardox Corporation, Chicago. A graduate of the University of Iowa, Mr. Oliver has been superintendent of the Cardox electrochemical plant at Claremore, Okla., for the past two years. DR. LAWRENCE M. LIGGETT succeeds Mr. Oliver as plant superintendent. Dr. Liggett received his doctor's degree from Iowa State College where he was formerly an assistant instructor of analytical chemistry. DR. JAMES A. TAYLOR has joined the research division of Cardox Corporation as chemical engineer.

▶ CHARLES SCHWARZLER has been appointed manager of the export department of The Foxboro Co., Foxboro, Mass., succeeding the late Henry B. Moelter. Formerly manager of the sales promotion department, Mr. Schwarzler has had ten years of experience in the application, promotion and sale of Foxboro instruments.

▶ IRA B. STIEFEL has been appointed assistant to the vice-president in charge of industrial relations for the Westinghouse Electric & Manufacturing Co. Mr. Stiefel has been manager of industrial relations at the company's East Pittsburgh Works since 1937. His new headquarters will be in downtown Pittsburgh. Since joining Westinghouse in 1912 as

CARDOX

FIRE PROTECTION Here...

Can Mean More FIRE POWER For The Hard Fight Ahead

One major fire in a war industry—or a small fire that results in crippling damage by the extinguishing medium—may deprive our fighting forces of vital equipment.

For those critical hazards where fire *could* stop all production, *might* destroy your entire plant, Cardox Fire Extinguishing Systems afford maximum protection.

HOW CARDOX SYSTEMS PERFORM

You can protect one or numerous hazards of like or diverse nature with a Cardox System. Tons of liquid CO_2 maintained at a controlled low temperature in a single storage unit . . . released in timed, mass discharge through built-in piping systems . . . smother the fire and cool combustibles below re-ignition temperature. So rapidly is the Cardox CO_2 discharged—in tons for large fires, in pounds for small ones—that the actual burning time can be cut down to a very few seconds.

Because there is no damage by the extinguishing medium, men and machines are back at work quickly.

Cardox Systems are preventing interruption to vital war production by fires in such key industries as: Airplanes, Airplane Parts, Armor Plate, Aviation Carburetors, Aviation Engines, Cold Strip Steel, Electric Power, Engine Parts, Forgings, Motor Fuel, Plastics, Processed Fabric, Rubber Products, Solvents, Tanks, Tank Engines.

If you would like more detailed information on how Cardox Systems provide engineered fire protection for large or small fire hazards—indoors or out—write on your company letterhead for Bulletin 2224.

★ ★ ★

CARDOX CORPORATION
BELL BUILDING • CHICAGO 1, ILLINOIS

District Offices in New York • Washington
Detroit • Cleveland • Atlanta • Pittsburgh
San Francisco • Los Angeles • Seattle

How Cardox Systems Protect War Industries

- Timed discharges, as needed, through built-in piping systems . . . supplied instantly from a single storage unit holding tons (if required) of liquid Cardox CO_2.
- Mass discharge of Cardox CO_2 "knocks out" fire, by . . .
- Reducing oxygen content of the atmosphere below the concentration necessary for combustion, and . . .
- Cooling combustibles and fire zone below ignition temperature . . .
- Extinguishing fire quickly and completely *without* damage from extinguishing medium.

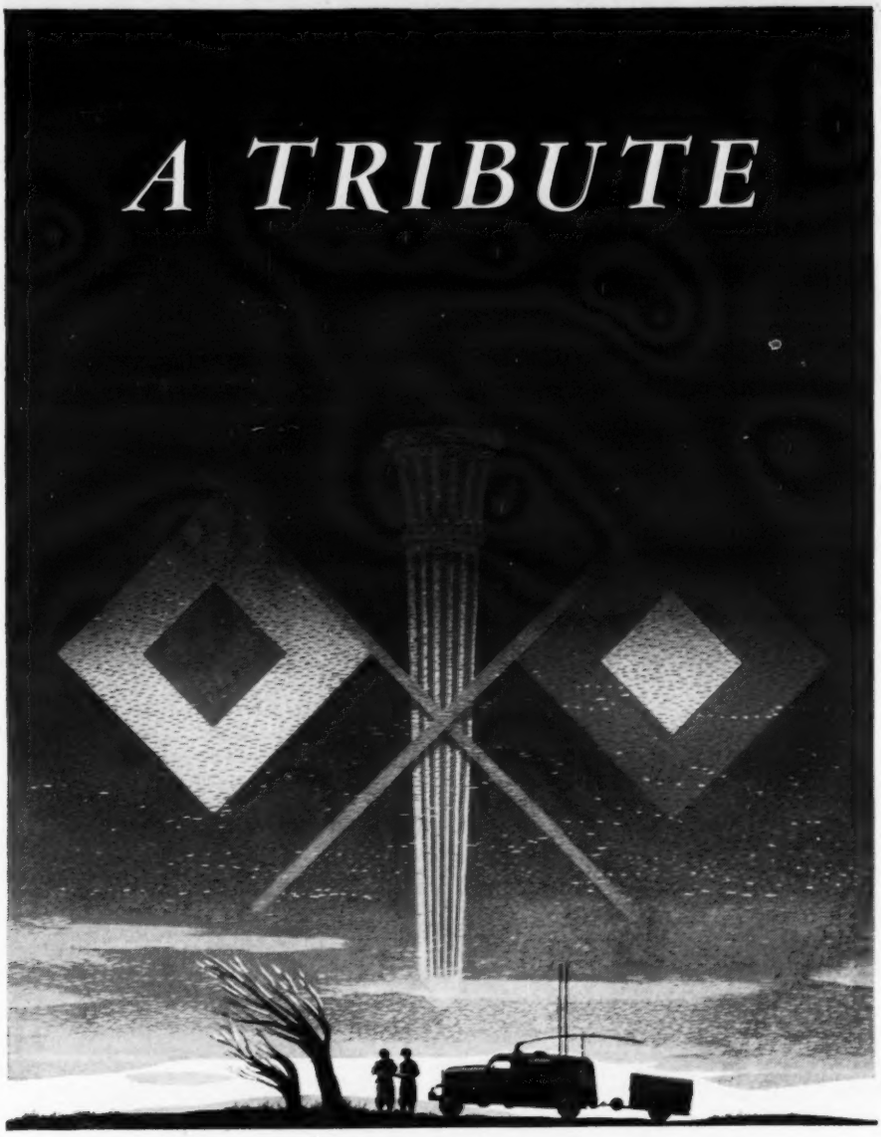
CARDOX—CO_2 Systems with Enhanced Fire Extinguishing Performance

A. Uniformity of CO_2 characteristics.
B. Extinguishing medium with uniformly greater cooling effect.
C. Accurate projection of CO_2 through greater distances.
D. Timed discharges, as needed, through built-in piping systems . . . supplied quickly from a single tank holding tons of liquid Cardox CO_2.

MASS DISCHARGE OF CO_2 · ENHANCED COOLING EFFECT · CENTRAL STORAGE UNIT · AMPLE CO_2 RESERVE · ENGINEERED SYSTEMS · MANUAL OR AUTOMATIC CONTROL

CARDOX

NON-DAMAGING FIRE EXTINGUISHING SYSTEMS



. . . to the members of the Signal Corps, United States Army, for their great achievements in the field of military communications. On every front, from the development laboratory to the most remote outpost, they are doing their job superbly well. . . . Hallicrafters employees are proud of the part they are privileged to take in the design and production of radio equipment for the Signal Corps.

hallicrafters RADIO

BUY MORE BONDS!

THE HALLICRAFTERS CO., MANUFACTURERS OF RADIO AND ELECTRONIC EQUIPMENT, CHICAGO 16, U. S. A.

a member of the company's graduate student course, he has been successively assistant superintendent of coils and insulation, assistant superintendent of the motor division, superintendent of mill and foundry, and manager of Feeder Division No. 1. In 1938 he was awarded the company's order of merit for his achievements in the field of employee relations.

▶ WORTH BURRELL has been placed in charge of the engineering department of the Berkshire Fine Spinning Associates, Inc., Providence, R. I., having been connected with the company for some years as a mill engineer. He succeeds the late Howard A. Stanley, who had previously been connected with the New England Power System, Boston, and for a time was general manager of the Fall River (Mass.) Electric Light Co.

▶ W. H. FELDMANN, vice-president and general manager of the Electric Machinery Mfg. Co., Minneapolis, Minn., since 1940, has been elected president and general manager of the company. SILAS MCCLURE, president since 1921, was elected to the chairmanship of the board of directors. Mr. Feldman has been associated with Electric Machinery for 22 years, having been in charge of district sales at Cleveland and Chicago before his appointment as general sales manager in 1927. In 1936 he was elected a director of the company, and in 1937 was made vice-president in charge of sales.

▶ A. H. HARDWICK has joined the executive sales staff of the International Resistance Co. Mr. Hardwick is well known throughout the radio and electronic fields, having been associated in the resistor industry for the past 16 years with Hardwick, Hindle, Inc., of Newark, N. J., whose presidency he relinquishes to assume his new duties.

▶ B. K. WICKSTRUM has been appointed Pacific Coast sales manager of Sylvania Electric Products Inc., for its lighting products. Mr. Wickstrum will have two assistants, C. W. Dickinson, manager of the Northwest division with headquarters in Seattle, and G. W. Field, manager of the California division, which includes Nevada, Utah and Arizona in addition to California.

▶ ADOLPH FRANKEL has been appointed to head the Westinghouse lamp division's electronic tube sales department, Bloomfield, N. J., which in two years has expanded its annual business by 20 times. Entering the advertising department in Bloomfield in 1917, Mr. Frankel later transferred to advertising

PERMANENT MAGNETS MAY DO IT BETTER

U. S. Signal Corps Photo

Engineered Savings!

Shortly after Pearl Harbor, our engineers recommended changes in the permanent magnets used in the GN-38 generator of the Signal Corps' field telephone, because the material then employed contained a high percentage of cobalt, the supply of which was limited.

Our engineers designed a new permanent magnet which exceeded specifications, yet has resulted in savings of more than:

- **150,000 pounds of cobalt**
- **140,000 pounds of other critical materials**
- **½-pound in weight per generator**
- **25,000 man-hours**
- **$1,000,000 in cost**

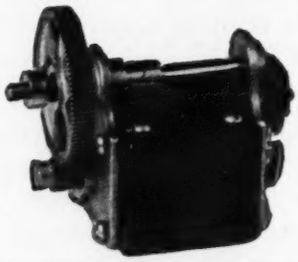


Photo Courtesy Kellogg Switchboard & Supply Co.

These savings are typical of the many benefits which have been realized through modern permanent magnet engineering. Because of our 34 years of specialized experience in this one particular field, our organization has played a leading role in designing and manufacturing permanent magnets for ever-increasing numbers of electrical and electronic devices for land, sea and air warfare.

This unusual experience should prove valuable to you in solving your engineering problems . . . and our engineers will be pleased to consult with you. Write us, on your letterhead, for the address of our office nearest you and a copy of our "Permanent Magnet Manual".

Help Win the War in '44—Buy War Bonds!

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The

INDIANA STEEL PRODUCTS

Company

★ SPECIALISTS IN PERMANENT MAGNETS SINCE 1910 ★

6 NORTH MICHIGAN AVENUE • CHICAGO 2, ILLINOIS

Better LIGHT for Better Traffic Sight

Years of specialized research have enabled Slater illumination engineers to meet the need for better light. Maximum efficiency of each Slater Lamp plus long life are the result of sound engineering, precision manufacture, and never any compromise with quality. Scores of tests and inspections of each lamp assure unfailing performance for the rated lamp life, under all conditions.

The fact that Slater Lamps are used exclusively throughout New York City . . . and in many other large and small municipalities . . . attest to their satisfactory service record in providing better light for better traffic sight. Write for Catalog.

SLATER ELECTRIC & MFG. CO.

BROOKLYN, NEW YORK

MANUFACTURERS OF STREET LIGHTING LAMPS, AND PRECISION ELECTRONIC TUBES

headquarters in New York City. In 1935 he was named merchandising manager of the lamp division, in 1939 returned to the Bloomfield Works as manager of special products sales and in 1942 became assistant manager of the special products commercial department. Last year he was appointed staff assistant to the manager of the lamp division.

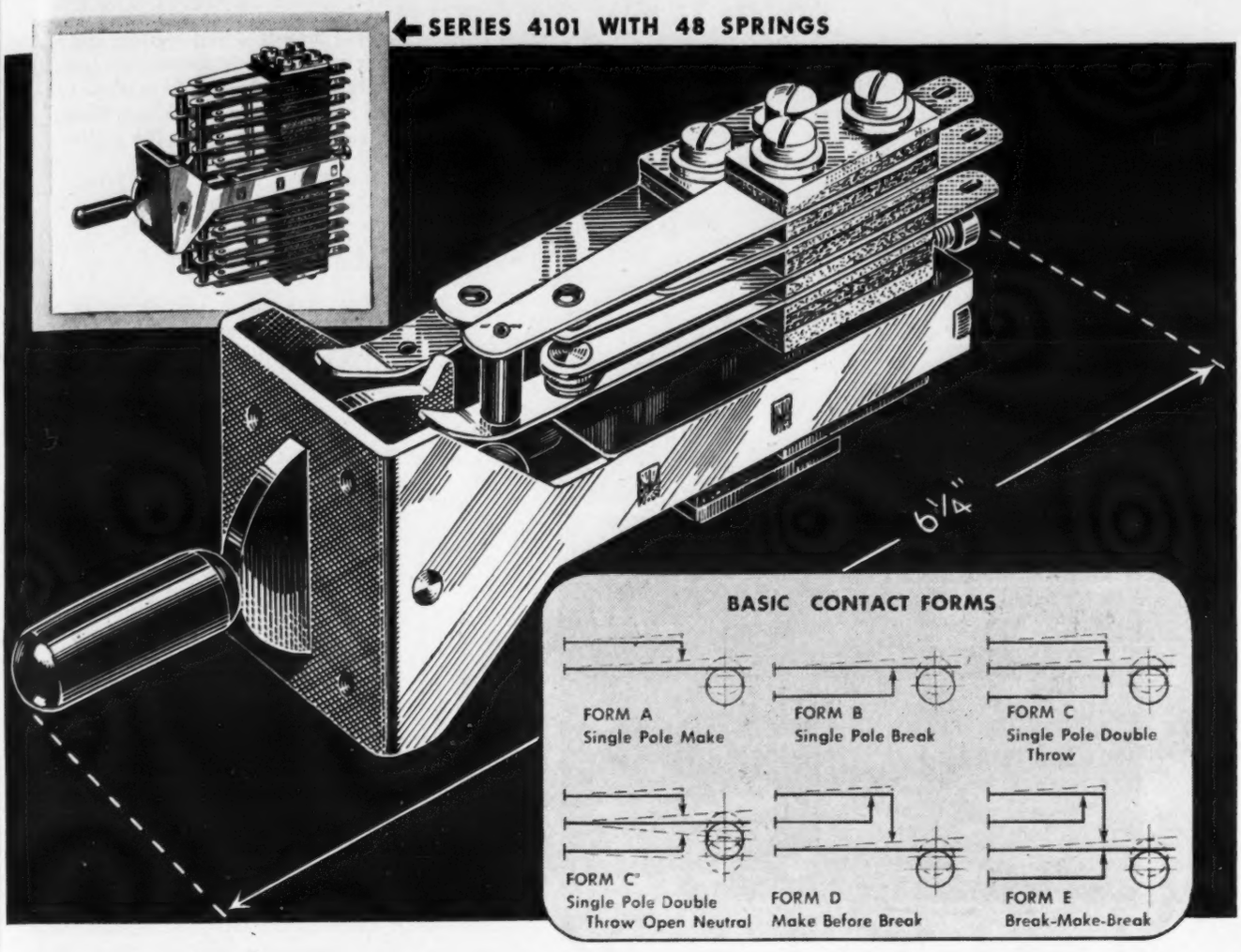
► HERBERT J. LEUPOLD has been appointed assistant superintendent of the testing department, Simplex Wire & Cable Co., Cambridge, Mass. He has been associated with the company for 20 years.

► FRED INGRAHAM has retired as manager of operations of the Chicago district of the American Steel & Wire Co., after more than 50 years association with that organization. HARRY H. LUMLEY has been named Chicago district manager to succeed Mr. Ingraham. Mr. Lumley has been assistant manager of operations in the Chicago district since 1940. W. E. MACKLEY has been appointed manager of the manufacturers sales department of the New York office. F. E. WARD has been named manager of sales at Buffalo, N. Y., succeeding Mr. Mackley, while F. L. NONNENMACHER has been made assistant manager of the manufacturers sales department in New York, replacing Mr. Ward.

► EDWARD J. HERZOG, recently returned from Venezuela where he was regional supervisor for the Caribbean Area, has been appointed manager of the oil and mining division of the Westinghouse Electric International Co., New York. In his new position, Mr. Herzog will direct all sales to the oil and mining industries outside continental United States and Canada. He succeeds RUSSELL D. HEATH, who resigned to organize his own company.

►J. W. BRYANT, formerly with the radio division of the Missouri State Highway Patrol, has joined the General Electric Co.'s electronics department, and will be located at the company's Chicago office. He will assist users of emergency communication equipment in the selection and installation of equipment for their needs in the central region of the United States.

► R. W. OWENS has been appointed assistant to the president of Elliott Company, Jeannette, Pa. A native of Morris, Ill., Mr. Owens received his technical education at the University of Illinois before joining the staff of Westinghouse in 1915. Successively a section engineer, manager of the industrial motor engineering department, general man-



UTILITIES FIND MANY CONTROL JOBS FOR

Mossman 4101 Heavy Duty Lever Switch

Each day the utility industry is finding new uses for the Mossman 4101 Heavy Duty Lever Switch as a control switch. Because it can be supplied in combinations as high as 48 springs (12 springs per pile-up, 24 springs per position), the Mossman 4101 permits a versatile control set-up of almost unlimited circuit arrangement.

Some of the unusual applications in the utility field are:

- Indication in remote control or telemetering circuits.
- Supervisory control circuits in load dispatching.
- Communication control circuits in utility and industrial plants.
- Testing and calibration in meter departments and for tube testing.

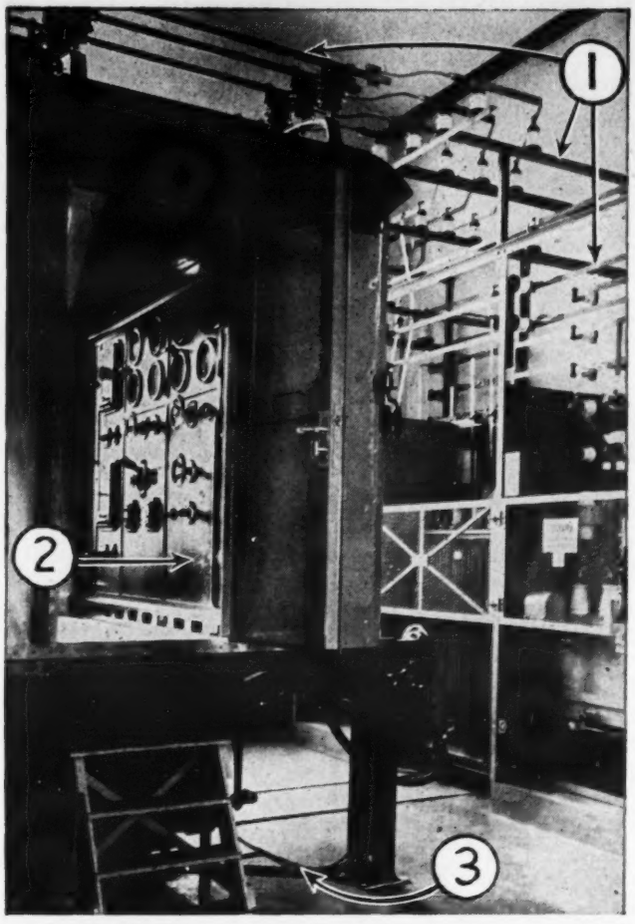
This switch can be furnished in any of the six basic contact forms illustrated above, or any combination thereof, for specific applications. The standard heavy duty contacts are of 3/16" diameter fine silver rated at 10 amperes, 110 volts, A.C., non-inductive. Extra heavy duty contacts are of 5/16" silver alloy—20 amperes, 110 volts, A.C., non-inductive. Breakdown rating of springs to ground is 2000 volts—alternating current.

Your engineers should have our new catalog which pictures and describes the 4101 Switch, and the full line of Mossman precision electrical components, including many types of heavy duty, multiple circuit lever switches, turn switches, push switches, plug jacks and special switching components. We will be glad to send as many copies as you require.

DONALD P. MOSSMAN, Inc., 6133 N. Northwest Highway, Chicago (31), Illinois

MOSSMAN

Electrical Components



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1 BUS BAR INSULATION—INSL-X #11
A 2 mil coating increases current carrying capacity of bus by over 27%. Dielectric strength 2000 v/m in thin layers—Highest emissivity.

2 SWITCH BOX INSULATION
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Tough. Acid, oil and grease resistant. Waterproof. Recommended for irregular surfaces, live parts, terminals, etc.

3 FLEXIBLE WIRE COATING
INSL-X #22
Stretches to double its length without breaking. Flexibility without loss of insulating value.

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ager of industrial engineering, and manager of the motor division in complete charge of engineering, manufacturing and sales, he brings to Elliott Company 28 years of practical design experience.

OBITUARY

E. Lovette West

E. Lovette West, who retired in 1929 as vice-president of the Niagara Hudson Power Corp., died of heart disease at his home in Bronxville, N. Y., on March 7. He was 68 years of age. Mr. West was born in Lakeville, N. Y., and was graduated from Cornell University in 1900.

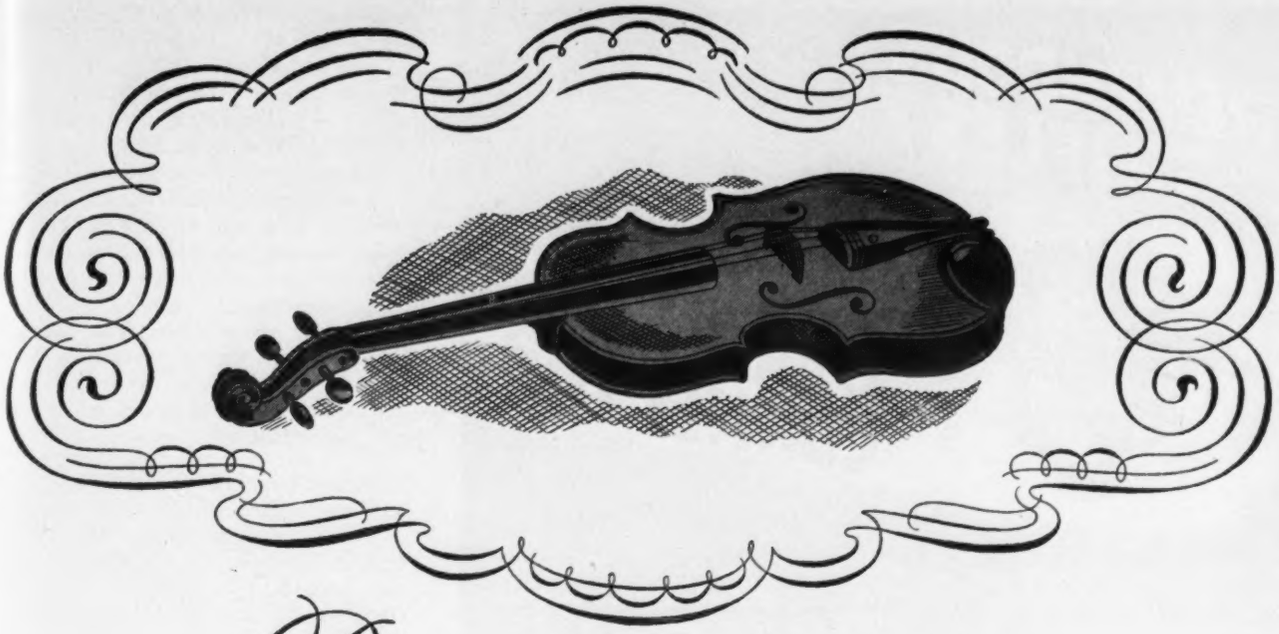
After spending eight years with J. G. White & Co., Mr. West became general manager of the Colorado Power Co., a position he held for four years. He was identified with the New England Power Co. 1912-14, and then for fifteen years served as president of the Metropolitan Edison Co., Reading, Pa., as well as president of the W. S. Barstow Management Association. During the latter part of this period he became a director of the General Gas & Electric Corp. and a vice-president of the Niagara Hudson Power Co.

•

► THOMAS E. CAMPBELL, lifetime leader of Arizona and Colorado river affairs and twice governor of the state, died March 1 in Phoenix at the age of 66. He was elected governor in 1918 and 1920. In 1917 he helped organize the League of the Southwest, the first organization of Colorado river basin states. After the war, Governor Campbell was chairman of a meeting of the governors of the seven states which drew up a resolution enabling legislation by Congress for the Santa Fe compact authority. Since 1922 when Arizona signed the compact, he had urged its ratification by the state, a wish fulfilled during the last special session of the legislature ten days before his death.

► HENRY REEVES, manager of the Union Electric Co. of Missouri at St. Charles, died suddenly from a heart attack at his home in that city on February 16. Mr. Reeves was 55 years of age.

► NEWTON S. TAYLOR, an executive in the switchgear and control division of the Westinghouse Electric & Manufacturing Co., died on February 21 at his home in Wilkinsburg, Pa., after a long illness. He was 55 years of age. A native of Lancaster, Ky., and a graduate of the University of Kentucky, Mr. Taylor entered the student course at the West-



Proved true by time

Time alone can prove how good capacitors are. The enviable reputation of Tobe Capacitors for *long life* rests on an almost complete absence of "returns". Such things don't "just happen". Back of Tobe Capacitors are constant research, specialized manufacturing experience and rigid inspections. Ratings are always on the conservative side.

Whatever your condenser problems, we invite you to put them up to our engineers. You will receive prompt service and close co-operation.

LONG LIFE ASSURED

TOBE DEUTSCHMANN CORP. TOBE CANTON · MASSACHUSETTS

TRS 605,
5 mfd. 600 volts
SIZE—
Overall height 5"
CONTAINER—
1 3/16" x 2 1/2" x 4"
Dimensions of other TRS models on request.

SPECIFICATIONS FOR TRS CAPACITORS

CAPACITY—.1 to 50.0 mfd.

WORKING VOLTAGE—
600 volts DC to 6,000 volts DC.

SHUNT RESISTANCE—
15,000 megohms per mfd.

RESISTANCE Terminal to Case—
10,000 megohms minimum.

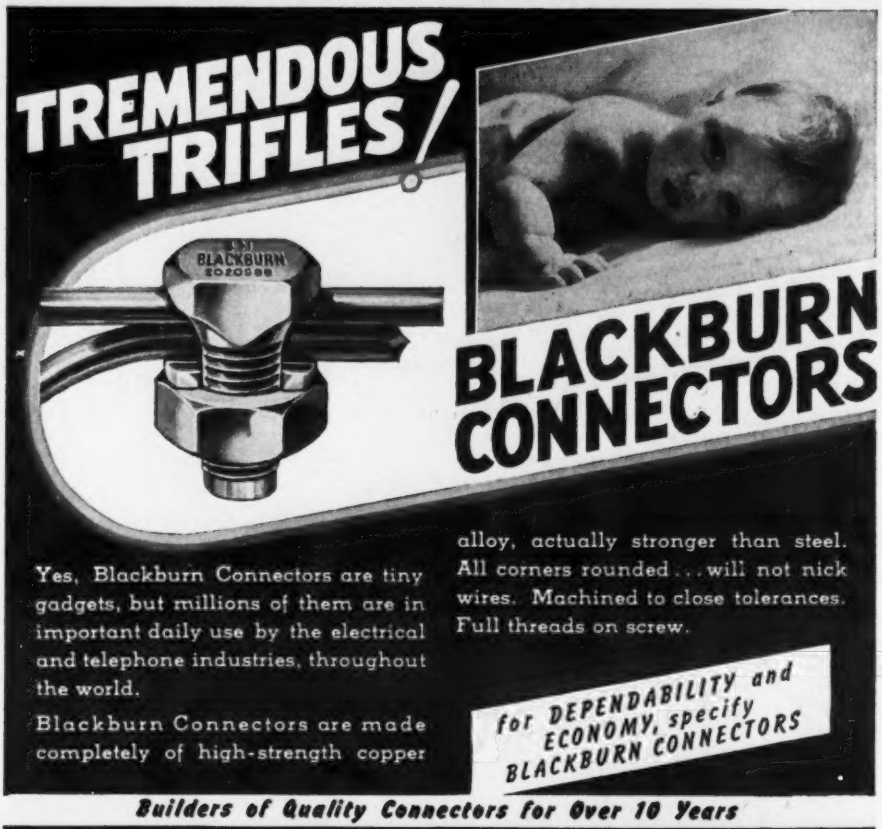
POWER FACTOR—.002 to .005

VOLTAGE TEST Terminal to Case—
2,500 VDC for 600 volt condensers.

Capacitor unit tested at 2½ times rated voltage.

Universal (wrap around) L or foot type and screw Spudenlug mounting brackets can be supplied.

A small part in Victory today . . . **A BIG PART IN INDUSTRY TOMORROW**



Yes, Blackburn Connectors are tiny gadgets, but millions of them are in important daily use by the electrical and telephone industries, throughout the world.

Blackburn Connectors are made completely of high-strength copper alloy, actually stronger than steel. All corners rounded . . . will not nick wires. Machined to close tolerances. Full threads on screw.

for DEPENDABILITY and ECONOMY, specify BLACKBURN CONNECTORS

Builders of Quality Connectors for Over 10 Years

JASPER BLACKBURN PRODUCTS CORP.
Main and Clinton Sts., St. Louis 6, Mo.
Over 75 Conveniently-Located Jobbers' Stocks

PAGE FENCE

America's First Wire Fence — Since 1883

Time to Check Up!

● If Page Chain Link Fence safeguards your property, now is the time to have it inspected, and reconditioned if necessary. Its protective life can be extended by the Page Fence distributor near you. He is a responsible, local business man with long experience. Consult him about all fence plans—present and future—including fence styles, engineering, erecting, repairs and moving. Write for FENCE FACTS and we will send name of Association member nearest you. Address PAGE FENCE ASSOCIATION, Headquarters: Monessen, Pa.

PRODUCT OF PAGE STEEL & WIRE DIVISION—AMERICAN CHAIN & CABLE COMPANY, INC., BRIDGEPORT, CONN.

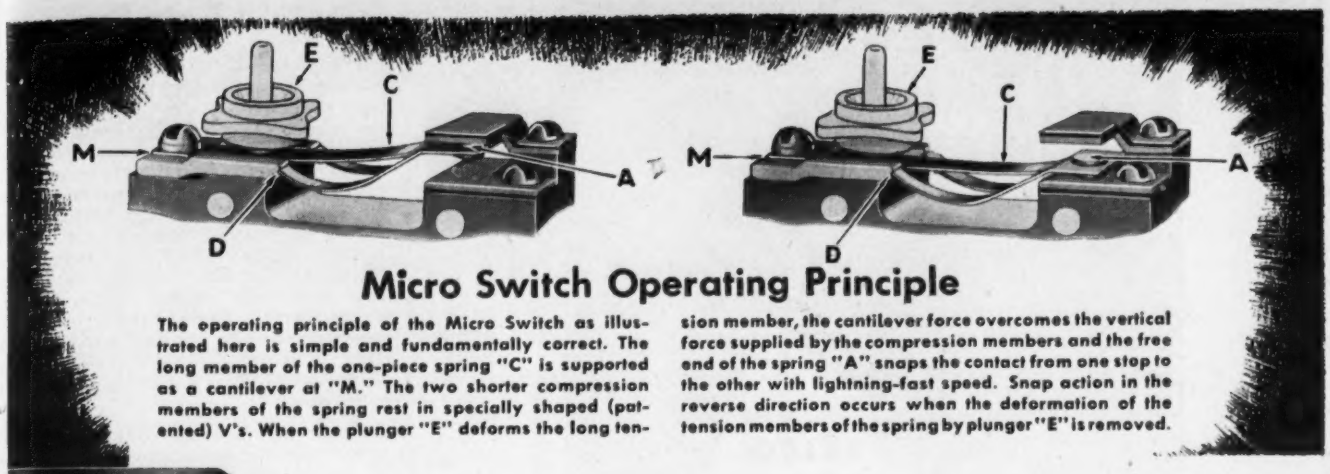
inghouse East Pittsburgh Works in 1909. At its completion, he became a member of the switchboard sales department. Except for a few years in Denver, Colo., where he was a switchboard specialist, Mr. Taylor has been located at East Pittsburgh for 35 years, serving as manager of the switchboard section, head of the large oil circuit breaker and switchboard section, manager of switchgear apparatus and, more recently, supervisor of switchgear order service. In 1942, Mr. Taylor received the Westinghouse Order of Merit for his outstanding work in speeding delivery of circuit breakers and other equipment to the U. S. Navy and war industries.

▶ JOHN CAMPBELL, organizer and for 31 years superintendent of the special service department, Boston Edison Co., died at Reading, Mass., March 6. He was born in Charlestown, Mass., 70 years ago, and was widely known in the eastern utility field. Mr. Campbell retired in 1939.

▶ WILLIAM J. DAVIS, JR., retired General Electric consulting transportation engineer, died February 21 at Ellis Hospital, Schenectady, N. Y., after a long illness. Mr. Davis retired in 1930, after more than 35 years of service. Born in Louisville, Ky., Mr. Davis was graduated from Rose Polytechnic Institute in 1892 and was first employed by General Electric in the company's test course at Lynn, Mass. In 1921 he became identified with the company's railway engineering department at Schenectady. When that department became known as the transportation engineering department in 1929, he was named a consulting engineer to the then new department engineer, H. L. Andrews, who is now a company vice-president.

▶ BEVIS LONGSTRETH, president of the Thiokol Corp., Trenton, N. J., manufacturer of synthetic rubber, died on March 1 at Roosevelt Hospital, New York, after an operation. He was 50 years old. Mr. Longstreth was born in St. Louis, was graduated from Princeton University in 1915 and then attended Harvard Law School. Twenty years ago he founded the Thiokol Corp.

▶ HAROLD R. WAKE, secretary of the Aluminum Co. of Canada, Ltd., died in a hospital in Charlotte, N. C., on March 2 in his fifty-third year. A native of Genoa, Neb., Mr. Wake had been associated with the aluminum industry since his graduation from the University of Nebraska. His first connection with the Aluminum Co. of America was at Alcoa, Tenn. Later he was at the company's Badin plant in North Carolina and then he was transferred to Arvida, Que. He moved to Montreal in 1937 on being appointed secretary.



Micro Switch Operating Principle

The operating principle of the Micro Switch as illustrated here is simple and fundamentally correct. The long member of the one-piece spring "C" is supported as a cantilever at "M." The two shorter compression members of the spring rest in specially shaped (patented) V's. When the plunger "E" deforms the long tension member, the cantilever force overcomes the vertical force supplied by the compression members and the free end of the spring "A" snaps the contact from one stop to the other with lightning-fast speed. Snap action in the reverse direction occurs when the deformation of the tension members of the spring by plunger "E" is removed.

MICRO SWITCH
PROVIDES LIGHTNING-FAST SNAP-ACTION CONTROL OF ELECTRIC CIRCUITS

Gives Reliable and Positive Operation, Accurately Repeated, Over Millions of Cycles

Experience of utility engineers with millions of Micro Switches in a great variety of applications has shown performance ability and operating characteristics never before found in snap-action electric switches.

Such performance is made possible by use of the unique, field tested, and proven operating principles of the Micro Switch. The snap motion of the Micro Switch contact is in the same direction as that of the operating plunger. There are no reverse bends in the Micro Switch spring, and there is no life-limiting "oil can" action.

Small size, high electrical rating, ability to operate satisfactorily for millions of operations on minute movement and force differentials, availability in various types of housings and a wide range of actuators . . . have made Micro Switch the choice of utility engineers for precise operation of many types of equipment.

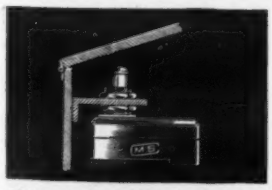
Micro Switch is Underwriters' listed and rated at 1200 V.A., at 125 to 460 volts a.c. Capacity on d.c. loads depends on load characteristics. A wide variety of basic switches and actuators provides characteristics varying from high vibration resistance to sensitivity requiring only 2/1000 ounce inches of operating energy.

Micro Switch Handbook-Catalog No. 60 will give you complete details as to electrical characteristics, construction, application and dimensions. We will send you as many copies as you may need.

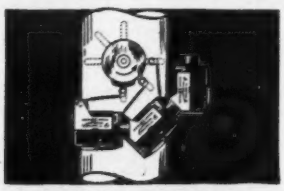
Micro Switch Corporation, Freeport, Ill.
Branches: 43 E. Ohio St., Chicago (11) • 4900 Euclid Ave., Cleveland (3) • 11 Park Pl., New York City (7) • 1709 W. 8th St., Los Angeles (14) • Sales & Engineering Offices: Boston • Hartford

BUY ALL THE BONDS YOU CAN

A FEW EXAMPLES OF MICRO SWITCH APPLICATIONS

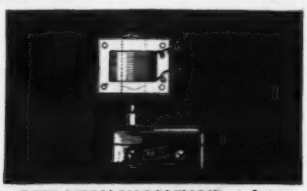


CABINET DOOR SWITCH. For safety alarm, or interlock on H. T. cabinets, transmitter or switch compartments. Panel mount switch normally open.



DRAFT INDICATOR. Can be operated by a cam on the draft shaft, three switches make contact at "open," "half" and "closed" positions.

CAM ACTUATION. Metal Clad Micro Switch with Roller Arm Actuator operated by sliding cam. Characteristics may vary with operating conditions.



OPERATION BY SOLENOID. A Solenoid may be used to operate a spring plunger Micro Switch, to control other circuits.

The trademark MICRO SWITCH is our property and identifies switches made by Micro Switch Corporation

© 1944

MICRO MS SWITCH
(TRADE MARK)

Made Only By Micro Switch Corporation . . . Freeport, Illinois, U.S.A.

Recent Rate Rulings

PORTLAND GENERAL ELECTRIC CO. lost a decision recently when Judge George R. Duncan in circuit court in Salem upheld the validity of an order by George H. Flagg, public utilities commissioner, requiring the utility to reduce its rates to consumers in Portland and adjacent areas by approximately 10 percent. Judge Duncan ruled that Commissioner Flagg did not have authority to issue his emergency order of last December, but that the order as a whole was valid under another statute, in which the legislature delegated power to the commissioner to make investigations and reductions. Portland General Electric has filed in the circuit court a petition for rehearing of its case.

PUGET SOUND POWER & LIGHT CO. will save residential and commercial customers in Seattle and throughout its Washington system $700,000 a year under the new rate schedule filed with the Department of Public Service at Olympia, Wash., effective April 1. Top step of the rates will be reduced from 3.5 to 3.2 cents a kilowatt-hour, matching a new rate announced by Seattle City Light early in February, which will save its consumers $300,000 annually.

SAVANNAH ELECTRIC & POWER CO. has been ordered by the Georgia Public Service Commission to make a reduction of approximately 10 percent in its residential rates. The commission estimated the savings to consumers at $75,000 annually. Commission Chairman Walter McDonald said the commission had denied a request from the U. S. Maritime Commission for reduction in the charge for power for the McEvoy Shipbuilding Corp. and the Southeastern Shipbuilding Corp. "After giving consideration to both the Savannah residential and wholesale power rates, the commission decided that the entire amount of revenue loss which could be justified at the present time should be applied by the company in the charges for electric residential service, so the charges for the electric power delivered to the two shipyards will not be revised," Mr. McDonald said.

CONSOLIDATED GAS ELECTRIC LIGHT & POWER CO., Baltimore, through its president, Charles M. Cohn, has filed an answer with the Maryland Public Service Commission to a complaint made by the city in which it was charged that an investigation the municipality has cause to be made leads to the conclusion that the rates for electricity and gas furnished to the city are unfair and unreasonable. At the same time the municipality, with the approval of Mayor Theodore R. McKeldin, asked the commission to institute an investigation of the rates and set the complaint for a hearing. The company's answer contended that the rates are fair, just and reasonable. It asks that the commission dismiss the complaint.

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New Output Record

Power output and gross revenues of the Commonwealth Edison Co. of Chicago, for the fifth consecutive year, reached record high levels during 1943 and currently 40 percent of the company's power sales is going into war production, Charles Y. Freeman, chairman, announced last week in the annual report to stockholders.

"Busy HIGHWAY BODIES"

● Over the highways of the nation, along right-of-ways, through city and country streets, wherever utilities serve in maintaining America's outstanding light and power service . . . there can be seen HIGHWAY BODIES of varied types.

The answer to HIGHWAY BODY popularity has been in the special designing of each body for the specific service. HIGHWAYS are kept busy because of the built-in advantages that facilitate work. Some of these are roominess, comfort to the crews, convenience in arrangement, lightweight yet ruggedness, compactness, sufficient carrying space, and durability.

HIGHWAY BODIES, because of conformance to utility service needs, will again be a logical choice when post-war construction gets under way.

HIGHWAY TRAILER COMPANY

MANUFACTURERS OF

TRUCK TRAILERS AND BODIES • EARTH BORING MACHINES • WINCHES • OTHER PUBLIC UTILITY EQUIPMENT

General Offices

EDGERTON, WIS., U. S. A.

MANUFACTURING-MARKETS

Post-War Appliance Boom Predicted

During the first five years following the war an annual average of 78 percent more Westinghouse electrical household appliances will be sold than were distributed in either of the peak years of 1940 and 1941, according to nation-wide estimates made by 102 distributors of the company's electric appliance division. T. J. Newcomb, divisional sales manager, who released the survey, in explaining that the post-war estimates were made to assist Westinghouse appliance factories to make plans for post-war production, said that the survey covered thirteen appliances and was based on the assumption that the first post-war year estimated would be the first year in which industry would be free to produce without restrictions of Government control or material shortages.

The estimates brought out the following average increases anticipated: refrigerators, 48 percent; ranges, 72; water heaters, 118; washers, 97; ironers, 183; fans, 29; vacuum cleaners, 67; small-air conditioners, 138; roasters, 36; irons, 58; small appliances, 66; water coolers, 82, and dishwashers, 818.

•

Allis-Chalmers Plans New Preferred Issue

Allis-Chalmers Manufacturing Co. has called a special stokcholders' meeting on March 30 to authorize a new issue of 300,000 shares of convertible preferred stock totaling $30,000,000. The stock will be offered to common shareholders in the ratio of one share for each six common shares held. At the same meeting the stockholders will be asked to approve a proposed increase in the authorized number of common shares from 2,500,000 to 2,750,000 in order to provide sufficient common stock to meet conversion requirements of the new preferred stock.

Part of the proceeds from the sale of the proposed new preferred stock would be used to retire $15,000,000 outstanding 4 percent convertible sinking fund debentures due 1952 and the remainder to supplement working capital and provide funds for the possible acquisition of additional plants and equipment, now or after the war.

•

Sees Large Utility Truck Replacement

A survey made by the American Coach & Body Co., Cleveland, Ohio, through personal contacts with utility executives during the past six months, indicates that 20 percent of all utility company trucks will be replaced within twelve months after "V" day.

Additional new trucks will be needed to bring utility fleets up to pre-war numbers, or higher, if plans to build thousands of new homes in the immediate post-war period materialize, the analysis revealed. These projects will call for miles of new power and telephone line construction, a job for line trucks, meter and telephone installers' trucks and all types of service equipment.

In preparation for these post-war problems, the American Coach & Body has issued a folder describing its replacement plan, the object of which is to speed the production and delivery of utility bodies and mechanical equipment when governmental restrictions are terminated.

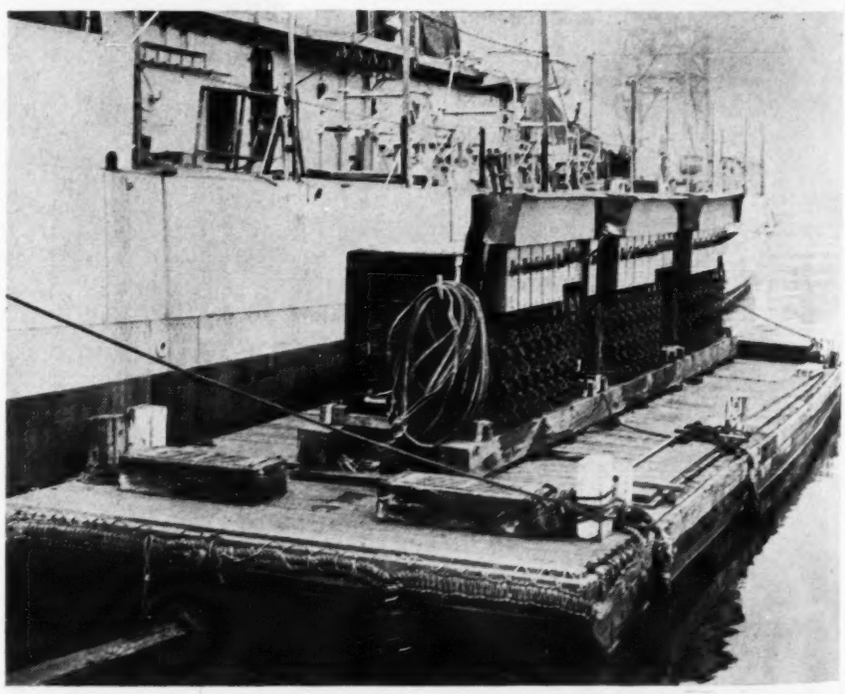
•

Reconversion Held Gradual, Complex

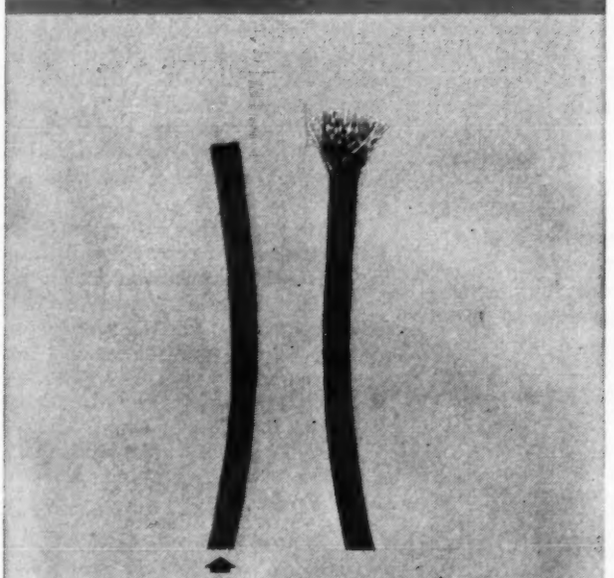
Recent postponement by government and industry of the approximate date for commencing the change-over from the manufacture of war goods to civilian production probably will mean that reconversion, when it comes, will be less gradual than anticipated, J. H. Rasmussen, commercial manager, the Crosley Corp., Cincinnati, stated in a recent address at the annual meeting of the Michigan Retail Hardware Association in Lansing.

Mr. Rasmussen urged the hardware dealers to remember, in making their post-war plans, that the retail sales turn-over on radios and household appliances is about three times the average for hardware stores.

"Our opinion of what the future holds



BARGE-MOUNTED LOAD RESISTORS—At the yard of the Seattle-Tacoma Shipbuilding Corp., in Seattle, Wash., G.E. barge-mounted load resistors are used to test the generating equipment aboard newly launched ships. Each barge has three screened-top water boxes, each mounting a bank of Calrod heaters. When the barge is alongside ship, the resistors are connected to the ship's switchboard by long cables, and the generators brought up to normal full-rated voltage



THIS—NOT THIS

SNUB TEST

Proves non-fray feature of new BH Fiberglas Sleeving

NEW, BH Extra Flexible Fiberglas Sleeving *will not fray,* even under severe conditions. You can prove this *right at your desk.* It's easy as snubbing out a cigarette. Here's how:

Write us for a sample of BH Extra Flexible Fiberglas Sleeving equal in size to the saturated sleeving you use now.

Hold short pieces of both BH Fiberglas Sleeving and the usual saturated sleeving between your thumb and index finger, and snub the ends of both sleevings against your desk, similar to the way you would snub out a cigarette. Do this five to ten times, pressing hard.

BH Flexible Fiberglas Sleeving will spread slightly under this pressure, may fuzz a little, but *will not fray.* The usual saturated sleeving will break down at the edges and separate.

Continued snubbing will not noticeably affect the BH Extra Flexible Fiberglas Sleeving, whereas the saturated sleeving will readily unravel and become progressively worse.

NON-FRAYING • FLEXIBLE • HEAT-RESISTANT
NON-INFLAMMABLE • WATER-RESISTANT
NON-CRYSTALLIZING at LOW TEMPERATURES

The new BH Extra Flexible Fiberglas Sleeving is woven from the choicest continuous-filament Fiberglas yarns. It possesses high dielectric strength, is water-resistant and, like all BH Sleeving and Tubing—is non-inflammable.

All sizes from No. 20 to $\frac{5}{8}$", inclusive, are available. Write for samples of this radically new and different sleeving today—in the sizes you desire. Seeing is believing! Bentley, Harris Manufacturing Co., Dept. W, Conshohocken, Pa.

BH PRODUCTS

NON-BURNING IMPREGNATED MAGNETO TUBING • NON-BURNING FLEXIBLE VARNISHED TUBING • SATURATED AND NON-SATURATED SLEEVING

BENTLEY, HARRIS MANUFACTURING CO.
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RELIABLE CAN HELP YOU

SAVE TIME

in speeding the war program by using Reliable Straightline splices on new construction and on maintenance.

SAVE COPPER

by using these perfect joint making units over and over again.

Positive

Permanent

Low in Cost

Reliable ELECTRIC COMPANY
OVER 35 YEARS SERVICE TO THE UTILITIES

for the radio and major household appliance industries," he stated, "is clearly indicated by our own plans. We are now laying our plans for a still further expansion of our enlarged program, which was started in 1940, with a view to the larger markets which we believe will exist after the war. We have set a pace that we can't easily forget. In 1940, our sales increased to $16,900,000 and, in 1941, they were over 27 millions. In 1942, our sales rose to $43,000,000 and in 1943 to $80,000,000. Our program this year calls for the production of $115,000,000 in war materials . . ."

C. S. Davis, president of Borg-Warner Corp., stated at a recent post-war planning conference, that reconversion of industrial plants to the production of civilian goods will be a much more complex process than their original conversion to war production. War production, Mr. Davis pointed out, will not be stopped abruptly, but will be a gradual and irregular process, making it more difficult to plan time and pace of reconversion.

•

U S. Aid Urged for New Product Development

Formulation of favorable national policies is essential to insure the development and large-scale manufacture of new and improved products for civilian use in the post-war era, a committee report to the National Association of Manufacturers emphasized recently.

The study, prepared by a group under the chairmanship of David C. Prince, vice-president of General Electric Co., asserts that American scientists have made in the four war years more progress than normally would take place in a quarter of a century. Governmental policies to insure continuance of this program, the committee recommended, must encourage inventors to develop new products, investors to invest in them and manufacturers to produce them.

•

Norge Division Resumes Kitchen-Range Output

Norge division of the Borg-Warner Corp. has resumed production of kitchen ranges, in the same plant making assemblies for fighter planes and gun turrets for dive bombers, Howard E. Blood, Norge president, has announced. WPB has authorized the resumption.

The new ranges—standard models 20 in. wide and 36 in. high—will be shipped to more than 7,000 distributors throughout the United States, Mr. Blood said. They will be made available to consumers through certificates issued by local rationing boards.

FLOORS that help REDUCE WASTE

Light-Reflecting Floors made with Atlas White cement help employees do better work

Much waste due to accidents—errors—spoilage—loss of time and manpower—can be reduced or eliminated by better seeing. And a new aid to lighting systems is available—Light-Reflecting Floors made with Atlas White portland cement instead of with normal gray portland cement.

Such floors reflect light rather than absorb it—make existing lighting systems much more efficient. They reduce shadows and, being close to work areas, put more light where it is needed. Installations already made in several of the country's largest plants have demonstrated the value of these white-cement floors by test and by experience.

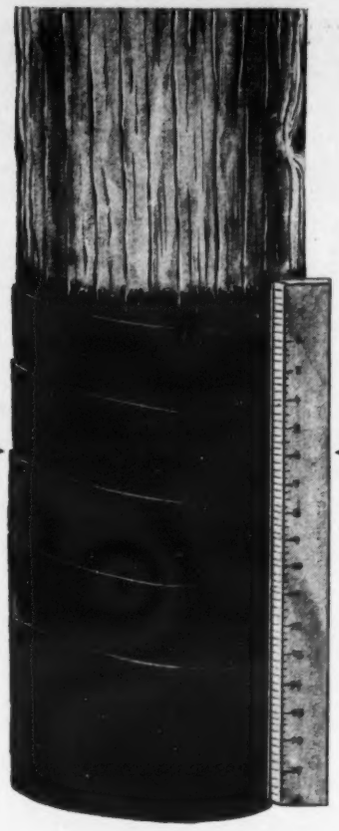
Light-Reflecting Floors made with white instead of gray cement fit into modernization and conversion programs as well as new structures. An interesting book, "Light From Floors," tells the entire story of development, testing, use and cost. For your copy, write to Atlas White Bureau, Universal Atlas Cement Company (United States Steel Corporation Subsidiary), Chrysler Building, New York 17, New York.

HOW ABOUT MAINTENANCE?

Experience shows white-cement floors are easy to clean, easy to keep clean, and retain their reflection advantage. Maintenance is simple—frequent sweeping, occasional damp mopping, periodic scrubbing.

SW-7-28

ATLAS WHITE CEMENT
For Light-Reflecting Floors



IT CAN'T HAPPEN HERE WHEN IT'S TREATED WITH OSMOPLASTIC

● The situation illustrated above has been repeated more than a million and a half times. How much in dollars Osmoplastic has saved electrical utilities, we wouldn't even hazard a guess. We know, however, that were it not for Osmoplastic ground line treatment, many companies would be hard put now in these days of critical pole and labor shortages . . . a condition which is just as serious in the woods as it is in Utility stockpiles.

There is no special "season" for Osmoplastic treatment. Whenever you inspect your poles, protect them with Osmoplastic. Simplified record systems are available to expedite and control the work. We would like to give you the full story at your convenience.

A few of more than a hundred leading utilities that have conserved poles by treating more than a million and a half of them with Osmoplastic.

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NEW JERSEY BELL TELEPHONE COMPANY
THE MOUNTAIN STATES TELEPHONE AND TELEGRAPH COMPANY
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VIRGINIA ELECTRIC AND POWER COMPANY
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BROOKLYN EDISON COMPANY, INC.
The Edison Electric Illuminating Company of Boston
METROPOLITAN EDISON COMPANY
Rochester Gas and Electric Corporation
PENNSYLVANIA POWER & LIGHT COMPANY
Public Service Electric and Gas Company
DETROIT EDISON COMPANY
APPALACHIAN ELECTRIC POWER COMPANY
CONSUMERS POWER CO.
JERSEY CENTRAL POWER & LIGHT CO.
Wisconsin Public Service Corporation
WEST PENN POWER COMPANY
New York State Electric & Gas Corporation
Northern Pennsylvania Power Company
PUBLIC SERVICE COMPANY OF COLORADO
NEW JERSEY POWER & LIGHT COMPANY
OKLAHOMA GAS AND ELECTRIC COMPANY
NIAGARA
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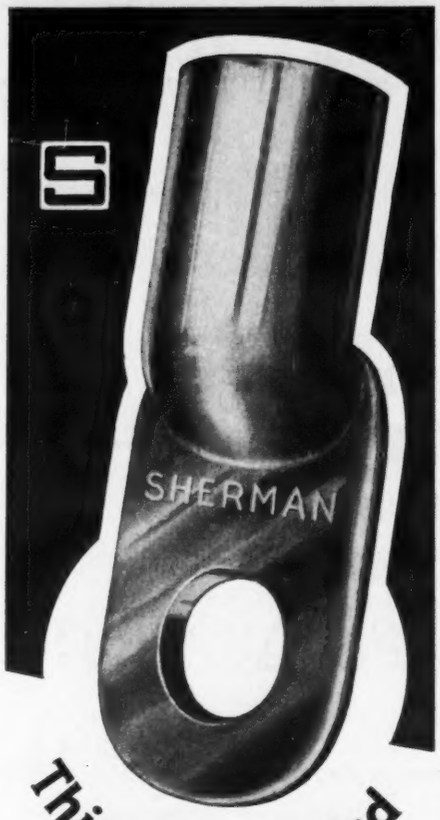


This CLOSED End Can't Leak Solder

Examine this Sherman Round End Lug and you'll see it is different from any other on the market. The round end is *completely closed*, so no solder can leak out to mess up the connection.

Sherman Round End Lugs are not made from tubing, but drawn on special machinery, from pure electrolytic wrought copper strip —rated at 100% conductivity. A bright, clean lug, with no burrs or sharp edges—and *flat* contact surface. Every lug individually inspected.

You can do faster, more economical, more efficient work with Sherman Lugs. Write for catalog.

H. B. Sherman Mfg. Co.
Battle Creek, Mich

•

Sherman
Electrical Fittings

Field Reports on Business

Machine tool and miscellaneous electrical supplies for outfitting supply vessels feature the electrical market. Considerable activity is also noted in substation improvements and hydro plant repairs. The demand for mica products is stepping up. Retail trade increased last week over last year's total.

CHICAGO

Washington recently approved resumption of work on the huge South Chicago steel mill under construction by DPC for use by Republic Steel Corp. Work on mill was suspended early this year by WPB although the entire project was well along toward completion. Current approval for continued construction covers the largest section of the mill and will cost an amount which unofficial estimates place at between $3,000,000 and $4,000,000.

In Detroit this week the Ford Motor Co. announced that it had received a $17,000,000 order from the army for additional units of the CG-13 Waco cargo glider.

Although such conditions have not been and are unlikely to be felt in Chicago for sometime, Washington is currently expressing concern over the "out migration" of war workers who formerly rushed to crowded industrial areas. This inclination of workers to "go home" is being cited by the armed forces as an argument for a national service act. The condition is most marked on the Pacific Coast, according to OWI.

Comparison of Chicago business indexes for Jan. 1944 with the same month of 1943 show improvements all along the line. Building contracts awarded (number) are up to 90.1 percent, factory payrolls are up 29.5 percent, electric power production up 8.7 percent and department store sales up 1.8 percent.

Electricity output of the Commonwealth Edison group of companies, excluding sales to other electric utilities, in the week ended March 4 totaled 198,207,000 kw.-hr. compared with 180,508,000 kw.-hr. in the corresponding week last year; an increase of 9.8 percent. The comparison for the preceding week showed an increase of 11.3 percent from last year.

NEW ENGLAND

New England Power System reports construction totaling about $1,500,000 completed in 1943, major items including coal handling and transmission facilities, extension of carrier current relaying, power plant and substation improvements, and hydro plant repairs. The engineering and construction division of the New England Power Service Co. also completed about $1,700,000 in 1943 work for the armed forces of the country and outside companies engaged in the war effort.

United States Rubber Co. has been allocated $1,600,000 for improvements in its Naugatuck, Conn., plant. Factory power equipment changes and additions in the Boston area have lessened as a result of slackening in small contract awards.

Government buying for outfitting supply vessels features both the machine tool and miscellaneous electrical supplies activity. New England firms have bid on more than 20,000 ft. of 3½-in. fiber conduit, 3,000 fittings, and wiring devices. The demand for mica products is stepping up and phenolic sheets for electrical insulating are selling at a good rate. New England firms have bid on salinometers, 4,000 toggle switches, and part of a large order totaling about 7,000 electric drills, besides voltmeters, heating elements and accessories, and cable.

Central Maine Power's merchandise sal in 1943 totaled $598,556 despite restrictio on appliance manufacture. Construction e penditures including 10 new busses f Portland, totaled $785,085. Yards whi are fitted to handle the construction of sm marines anticipate increased activity th year and the demand for highly specialize electrical equipment used on this type vessel will likewise broaden.

NEW YORK

Though declines were recorded in vario industrial quarters last week, the good sho ing of the steel industry and a substanti rise in car loadings did much to offset th decline. Steel ingot production was th largest since the week beginning last Oct ber 11, when output of ingots and castin established a new peak for the industry according to the American Iron & Ste Institute.

Civil engineering construction volume i continental U. S. totaled $44,579,000 la week. This volume is 13 percent high than in the preceding week, but declined 5 percent from the total reported to *Engineering News-Record* for the correspondi 1943 week. Private construction was 1 percent above the preceding week and 2 percent above last year as a result of th increased activity in large-scale private res dential building. Public construction wa up 14 percent, compared with the precedi week, but was 65 percent below a year ag The week's construction brought 1944 vo ume to $358,386,000 for the ten-week pe riod, a decrease of 49 percent from th $709,277,000 reported for the 1943 perio

Retail trade in the metropolitan area e panded last week, sales figures toppi those recorded a year ago.

PACIFIC COAST

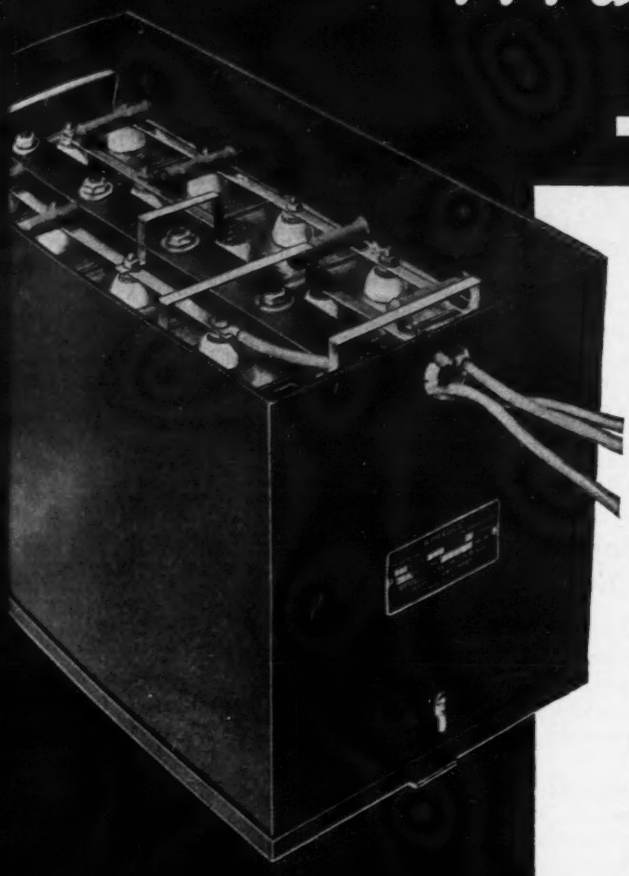
The scope and post-war continuance Pacific operations is evidenced by a $1 000,000 appropriation for an Army A Corps depot at Alameda, for warehousin and shipping equipment and, later, salva ing and re-storing it. Work has begun o this, the first permanent installation of it kind in Bay region. It is also indicated b such single recent orders as 50,000 electr soldering irons, $25,000 of connectors, an two carloads of wood pins and bracket New homes, 1,329 of them, said to compris the nation's largest single housing tract are to be built at San Lorenzo on East Bay Complete with community structures, the will cost $6,850,000. Other recent housin includes a San Francisco award of $1,020, 000 for 528 family dwelling units in Potrer area; and FHA allotments of 1,000 famil units and 1,000 trailer homes to Long Beach

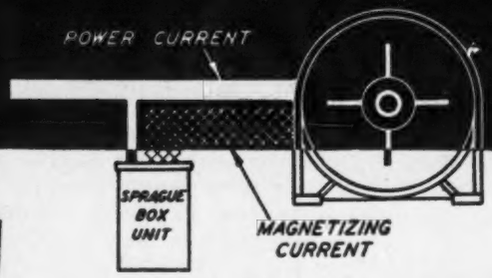
The Seattle city council has approved a $850,000 measure for providing increase capacity and necessary distribution line for the South substation.

A recent northern California survey b Pacific Gas & Electric Co., which has don distinguished work in farm electrification discloses that the 588 farms contacted re ported 2,586 motors in 53 different applica tions, totaling 7,863 hp.

QUICK, ECONOMICAL POWER FACTOR CORRECTION

... at the Source





In many cases, it is simpler, cheaper, and more practical to solve power factor correction problems *at the source* i.e., at the motor or other equipment itself, rather than at the transformer bank—a fact that Sprague Box-Type Capacitors have proved throughout industry. These Capacitors are available in 230, 460, and 475 volts, for 1-, 2-, or 3-phase systems, and in sizes from 1 to 10 Kva in single units, or grouped into nearly any size or capacity. Thus, one standard, economical design can be applied universally to cover an extremely wide range of applications. Write for details, including a copy of the helpful booklet "Sprague Capacitors for Power Factor Correction".

SPRAGUE SPECIALTIES CO.
NORTH ADAMS, MASS.

ARMY E NAVY

SPRAGUE

CAPACITORS

KOOLOHM RESISTORS

Maintenance and Servicing of Electrical Instruments

By

JAMES SPENCER

In charge of Instrument and Relay Department, Meter Division, Westinghouse Electric & Manufacturing Co., Newark, N. J.

●

REPRINTS AVAILABLE

This reprint should be of great value to all those whose problem it is to keep in operation the electrical instruments on vital war production as well as those on planes, signal equipment, tanks, ships, guns and other armament.

The electrical instrument industry has expanded more than 30 times its normal production, but its service facilities in general have not kept up with this pace. Some electrical instrument manufacturers do practically no servicing and cannot promise early return of the few instruments they accept for repairs.

This reprint should be useful to all instrument users, switchboard attendants, testing engineers, and instrument service men, as the accuracy and efficient life of instruments depend to a large extent on competent handling.

Durable fabrikoid binding, 256 pages, 5 x 8¼ inches, 274 illustrations. Price $2.00 postpaid.

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Enclosed is $.....to cover the cost ($2.00 each) of.....copies of SPENCER — MAINTENANCE AND SERVICING OF ELECTRICAL INSTRUMENTS.

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Sylvania Electric Opens New Hampshire Plant

Sylvania Electric Products, Inc., has acquired a 5-story building at Dover, N. H., formerly occupied by the Pacific Mills, and has established a branch manufacturing plant at this location. The output will be handled as a subdivision of the company's appliance plant at Ipswich, Mass. C. W. Haller has been appointed plant manager; Ernest Powers, manufacturing superintendent; Dr. Herbert Trotter, in charge of engineering; Harris Reinhardt, in charge of quality production; and David Christie, personnel director. Averill Pettingill has been made manufacturing superintendent at Ipswich.

Expansion of Sylvania's industrial apparatus plant at Emporium, Pa., has necessitated a transfer of the work to the company's Plant No. 2 at Williamsport, Pa., where additional space and personnel were available. Construction of a $100,000 addition to the plant at Towanda, Pa., was recently announced by the company. The plant will be owned by DPC, but operated by Sylvania. An addition was also started recently at the Warren (Pa.) plant.

●

Cordage, Incorporated, Organized by Kellogg

Announcement has been made by the Kellogg Switchboard & Supply Co., Chicago, of the formation of Cordage, Inc., devoted primarily to the manufacture of rubber-jacketed and retractable electrical cords.

Officers of the new organization are: C. D. Manning, president; R. D. Collins and H. D. Hurlbut, vice-presidents, and E. Johnson, secretary-treasurer. P. C. Geraty, for many years head of the insulating department of the Kellogg Switchboard & Supply Co., Chicago, has been appointed manager. Under the new organizational set-up, all orders for products of Cordage, Inc., will be handled through the Kellogg Company.

A major percentage of the new organization's output is, at present, being absorbed by the U. S. Army Air Forces and Signal Corps.

●

New Meter Reading Plan

The quarterly meter reading plan now in effect for customers in rural and unincorporated villages served by Wisconsin Public Service Corp. is being replaced with a bi-monthly meter and bimonthly billing schedule in the interest of greater customer satisfaction, it was announced recently in Green Bay.

How the electron works for you

Here is the kind of book you have been awaiting—an ABC book which will show any electrical worker or salesman of electrical supplies what electronics is all about. This book gives you simply—without formulas or much mathematics just what you want to know about electronic principles and how they are applied in working devices.

Just Published

A PRIMER OF ELECTRONICS

By DON P. CAVERLY

Commercial Engineer, Sylvania Electric Products, Inc.

235 pages, 5½ x 8½, illustrated, $2.00

Here is an especially clear and simple explanation of electronics and electronic tubes and circuits, for all concerned with the manufacture, application of operation of household or industrial electronic devices.

- **The text is concise and written in language that any one can understand, yet is technically authoritative and complete.**
- **More than 200 specially prepared illustrations are an important factor in the clarity of the treatment.**
- **The material has grown out of the widely-known series of articles in Wholesaler's Salesman.**

The book begins with the atom, the electron, and static and electron discharges and takes the reader step by step through explanation of electric current, magnetism, and electromagnetic radiation, to an understanding of simple radio tubes, fluorescent lamps, cathode ray tubes, ignitron, thyratron, and other tubes and their basic connection for practical purposes.

The book covers concisely, practically, so that any one may understand, such topics as: Production of radio waves; reception of radio waves; short-wave radio; frequency modulation; television transmission; television reception; ultra-high frequencies and microwaves; ranging and directing by radio; infra-red; ultra violet; hot cathode fluorescent light sources; fluorescent lamp circuits; cold cathode fluorescent light sources; bactericidal tubes; strobotrons; photo-electric tubes; cathode-ray tubes; iconoscopes, image-dissector tubes; facsimile recorder tube; X-ray tubes; electron microscope; electron tubes in general.

See it 10 days on approval

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Send me Caverly's A PRIMER OF ELECTRONICS for 10 days' examination on approval. In 10 days I will send you $2.00 plus few cents postage or return book postpaid. (Postage paid on cash orders.)

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STURD-E GUARDED

PIKE POLE

• The automatic guard adds immeasurably to the safety of this pole—the point is covered when not in use—completely guarded against damage. When in use, the tubular sleeve slides back and reenforces the head, adding to the service life of the pole.

The spike is forged from best quality steel, heat treated and tempered for long life. Handles are select fir—sanded and lacquered—lengths regularly furnished ten to twenty feet. For maximum service life, economy, and value, specify

STURD E TOOLS
a TRUE TEMPER PRODUCT

Automatic Tubular Pike Pole guard is shown in the phantom view above. Extremely simple in operation, it gives positive protection to the point of the pike.

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Sales Opportunities

WASHINGTON—Department of Public Utilities, Tacoma, plans extensions in power substation with installation of transformers, switchgear and auxiliary equipment. Project has been approved by City Council, and work will be carried out soon.

PENNSYLVANIA—American Viscose Corp., Delaware Trust Bldg., Wilmington, Del., will carry out expansion in two plants for high-tenacity rayon production for government, including new buildings with machinery and electrical equipment. Also plans extensions in power plants at both mills, for required power supply for larger operations. Cost estimated at $4,000,000 and $750,000, respectively. Similar expansion will be made in branch mill in West Virginia, likewise for government output of high-tenacity rayon. Several new buildings will be erected and power plant enlarged. Cost estimated at $2,250,000, with machinery and electrical equipment. Financing in all cases will be by Defense Plant Corp. Work is scheduled to begin soon.

CALIFORNIA—Navy Department, Washington, D. C., has authorized expansion in a number of naval bases and camps in southern part of state, including shops, warehouses and other buildings, with mechanical and electrical equipment. Also barracks, mess halls and miscellaneous housing structures. Extensions will be made in electrical distribution systems, service connections and other facilities. Entire project will cost over $3,000,000. Bureau of Yards and Docks, Navy Department, Washington, will be in charge.

OHIO—Light and Power Department, Martins Ferry, has made recommendations to City Council for improvements in municipal power plant, including installation of new boiler and accessories, estimated to cost about $60,000. Thomas R. Jamison is superintendent, in charge.

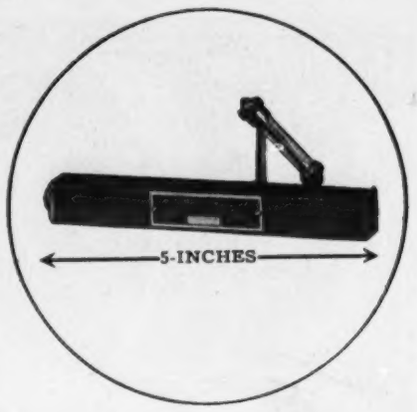
TENNESSEE — Municipal Light, Gas & Water Department, Memphis, is arranging fund of about $1,700,000 for early and postwar expansion and improvements in electrical system. Includes a new power substation, extensions in overhead lines, underground conduit system and substations. Remainder of appropriation for service connections and meter purchases. Another appropriation is being arranged for new motor-driven pumping machinery and auxiliaries for city water supply.

PENNSYLVANIA — Publicker Commercial Alcohol Co., 1429 Walnut St., Philadelphia. will carry out expansion in local plant for production for government, including new buildings with machinery and electrical equipment. Cost estimated about $4.000,000. with financing by Defense Plant Corp. Project will begin soon.

NEBRASKA—Stanton County Rural Public Power District, Stanton, plans extensions in primary and secondary lines, including service connections and other operating facilities. Application has been made for permission.

WASHINGTON — Black Diamond Public Water District, Black Diamond, care of Parker & Hill, Smith Tower Bldg., Seattle, consulting engineers, plans pumping plant with motor-driven pumping machinery, in connection with new water supply project. Entire program will cost approximately $100,000.

CALIFORNIA—Stauffer Chemical Co., 555 South Flower St., Los Angeles, has approved



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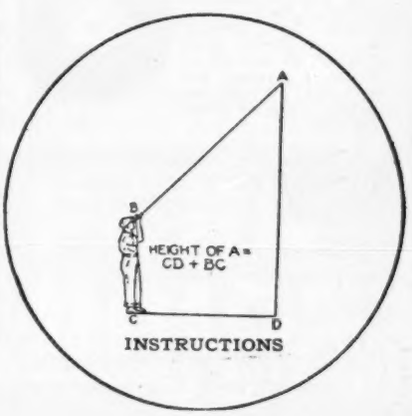
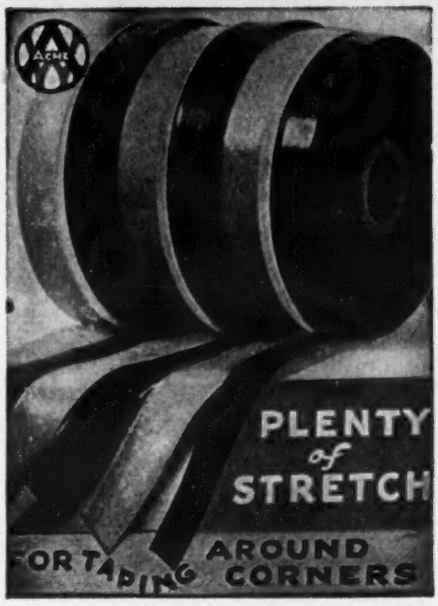


INSTRUCTIONS



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Sales Opportunities

(*Continued from p.* 175)

plans for new sulfuric acid plant, comprising three main one and multi-story buildings, with machinery and electrical equipment for large output. Cost reported over $500,000. Work will be placed under way at early date. Project has a priority rating. Main offices are at 420 Lexington Ave., New York, N. Y.

WEST VIRGINIA—Valley Camp Coal Co., Elm Grove, plans extensions in electrical distribution system at local mining properties. George Gater is company electrical engineer.

MICHIGAN—Water Department, Negaunee, plans electrification of municipal waterworks station, with installation of new motor-driven equipment. Estimates of cost are being made. Proposed to make application soon for a priority rating. Greeley & Hansen, 6 North Michigan Ave., Chicago, Ill., are consulting engineers.

ALABAMA—Central Foundry Co., Anniston, will carry out expansion in plant for production of magnesium castings for government, including additional buildings with machinery and electrical equipment. Cost estimated about $1,200,000, with financing by Defense Plant Corp. Sanderson & Porter, 52 William St., New York, N. Y., are engineers and will supervise building erection. Main offices of company are at 386 4th Ave., New York.

CALIFORNIA—Navy Department, Washington, D. C., has authorized expansion in Naval Personnel Depot, comprising warehouses and other buildings, with mechanical and electrical equipment. Also will make extensions in distribution system, power substation and other operating facilities, with additional service connections. Project will include new barracks, drill hall, headquarters building and other miscellaneous structures, and is estimated to cost about $4,100,000. Bureau of Yards and Docks, Navy Department, Washington, will be in charge.

MICHIGAN—Upjohn Co., Kalamazoo, manufacturer of drugs and pharmaceutical products, plans addition to power plant, with installation of additional equipment. Work is scheduled to begin soon. Albert Kahn, Inc., New Center Bldg., Detroit, is architect and engineer.

NORTH DAKOTA—State Board of Higher Education, Bismarck, plans new power plant at State Normal and Industrial School, as a post-war project. Estimates of cost are being made.

MICHIGAN—American Seating Co., Grand Rapids, manufacturer of furniture for public buildings, has contracted with government for extensions in plant, including additional factory structures, with machinery and electrical equipment. Cost estimated about $1,200,000, with financing by Defense Plant Corp. Work will be carried out at early date.

FLORIDA—City Commission, Fort Pierce, plans installation of motor-driven pumping machinery and auxiliary equipment, with controls, etc., in connection with extensions in municipal water system. Entire project is estimated to cost about $100,000. Financing will be arranged through federal aid. It is understood that Smith & Gillespie, Packard Florida Bldg., Jacksonville, consulting engineers, will prepare plans for project.

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REA Announces New Allotments

The Rural Electrification Administration has recently announced loan allotments totaling $2,296,000 to 32 rural electric systems in 12 states. These funds, which will be used to extend electric service to farms to aid in the food production program, bring total REA allotments to $480,576,241, of which $14,613,328 represents operations during the current fiscal year. No construction will be undertaken which does not have approval of the War Production Board.

Included are the following allotments:

ARKANSAS—Craighead Electric Co-operative Corp., Jonesboro, $205,000; Clay County Electric Co-operative Corp., Corning, $100,000.

ILLINOIS—Farmers Mutual Electric Company, Geneseo, $40,000; Illinois Valley Electric Co-operative, Inc., Princeton, $50,000; Menard Electric Co-operative, Petersburg, $100,000; Southeastern Illinois Electric Co-operative, Inc., Harrisburg, $40,000; Southwestern Electric Co-operative, Inc., Greenville, $50,000.

IOWA—Sioux Electric Co-operative Association, Orange City, $75,000; Adams County Co-operative Electric Company, Corning, $70,000; South Crawford Rural Electric Co-operative, Denison, $50,000; Pella Co-operative Electric Association, Pella, $60,000; Linn County Rural Electric Co-operative Association, Marion, $80,000; Buchanan County Rural Electric Co-operative, Independence, $50,000; Nyman Electric Co-operative, Inc., Stanton, $75,000; Southern Iowa Electric Co-operative, Inc., Bloomfield, $50,000.

KANSAS—Central Kansas Electric Co-operative Association, Inc., Great Bend, $120,000.

KENTUCKY—Harrison County Rural Electric Co-operative Corporation, Cynthiana, $26,000; Henderson-Union Rural Electric Co-operative Corporation, Henderson, $25,000.

LOUISIANA—Washington - St. Tammany Electric Membership Corporation, Franklinton, $50,000; Bossier Rural Electric Membership Corporation, Bossier, $50,000; Northeast Louisiana Power Co-operative, Inc., Winnsboro, $50,000; Dixie Electric Membership Corporation, Baton Rouge, $50,000.

MISSISSIPPI—Magnolia Electric Power Association, McComb, $50,000.

NEVADA—Alamo Power District No. 3, Alamo, $5,000.

NORTH CAROLINA—Cruso Electric Membership Corporation, Waynesville, $48,000.

OKLAHOMA—Caddo Electric Co-operative, Binger, $50,000; Southwest Rural Electric Association, Inc., Tipton, $70,000; Kiwash Electric Co-operative, Inc., Cordell, $50,000; Harmon Electric Association, Inc., Hollis, $50,000.

PENNSYLVANIA—Central Electric Co-operative, Inc., Parkers Landing, $50,000; Adams Electric Co-operative, Inc., Gettysburg, $425,000.

VIRGINIA—Shenandoah Valley Electric Co-operative, Dayton, $32,000.

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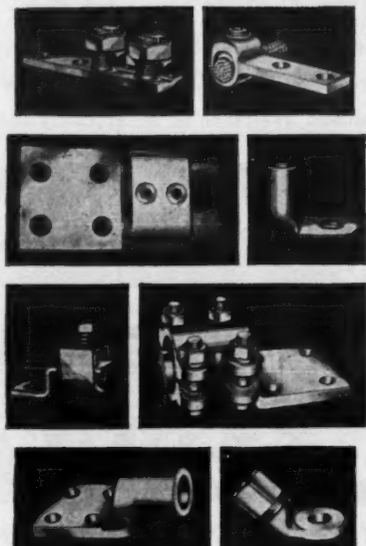

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Recent Legislation

Among the bills recently proposed in the legislatures of the various states affecting public utilities were the following:

KENTUCKY—Measure denounced by its opponents as a bill to repeal the 1942 Tennessee Valley Authority enabling act was reported favorably early last month by the state senate public utilities committee. Introduced by Senate Minority Leader Ray B. Moss, Pineville, the bill would forbid municipalities to construct a power plant in any community where a plant now exists or to obtain a plant by any means other than by purchase of the existing plant or by condemnation proceedings. It also provides for appointment of a board of appraisers to fix the value of the existing plant if the city wished to purchase such facilities, for appointment of commissioners if the city desired to condemn property of the existing plant, and outlined a formula by which the appraisers and commissioners would arrive at the value of the condemned electric property. Opponents of the bill declared at a public hearing that it deprived cities of the right to compete with private utilities, while proponents claimed it protected utility customers and investors. R. M. Watt, president of the Kentucky Utilities Co., said utility customers and investors "must be protected" and that the bill provided the "proper way to arrive at the proper value" of plants. W. C. Fitts, Knoxville, Tenn., TVA general counsel, declared that a competing plant or the threat of such a plant was the only bargaining power the cities had against private utilities. He said the bill would force cities to pay the "asking price" of the utilities, or resort to condemnation proceedings which were costly, lengthy, and unpredictable. The Senate passed by a 36 to one vote, a bill to permit cities of the second and third classes to transfer surplus funds from operation of municipally owned utilities to their general funds. The bill was introduced by Senator Lee Gibson of Calhoun, as sponsor, it being a measure to aid the city of Owensboro which operates its own electric plant, to convert surplus from such operations to city general use. On the same date the Senate completed a bill to advance Owensboro from a third to a second class city rating. Under the terms of a bill introduced in the House, consumers of gas, electricity and water would be given thirty days to pay their bills without penalties, instead of the customary ten days. The measure also would require: "No penalty for non-payment of such service bills of more than 6 percent of the total bill shall be imposed. No trick, device or subterfuge in the way of pretended discounts for prompt payment shall be permitted to evade the provisions of this section."

MISSISSIPPI—A bill has been introduced in the state Legislature to place utilities in the state, including gas, electric, telephone and telegraph under the jurisdiction of the Public Service Commission. The commission would investigate all rates, charges, cost of production, etc. According to Senator Howard McDonnell, who introduced the bill, "all other forms of utilities in the state, as well as others are under the jurisdiction of a commission and how these particular utilities have escaped so long and how they have been permitted to reap such exhorbitant profits without outside interference is amazing to say the least."

NEW YORK—Senate defeated the Burney bill amending the General Municipal Law.

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The amendment provided that "a municipal corporation furnishing a public utility service or services need not decrease its rates and charges for such service or services on order of the public service commission unless such order is issued upon notice and after hearing instituted upon the verified complaint of not less than ten percent of the active consumers, as shown by the records of the utility, residing in the territory in which the utility rate or rates referred to in said complaint is or are applicable." Governor Dewey has approved a bill turning over to the cities of the state more than $19,000,000 additional for the coming year. The money is from the state-collected, locally shared utility tax. An act to amend the public authorities law in relation to the creation of a power authority for the city of New York and defining its powers and duties has been introduced in the Assembly by S. Robert Molinari, Staten Island. The bill was introduced on behalf of the mayor of the city of New Yorw and authorized the creation of a power authority for the city. The bill contains the following features: (1) . . . It authorizes the creation of a power authority for the city of New York subject to the approval of the electors of such city. (2) . . . The authority is to consist of one to seven members with overlapping terms of six years; not more than a majority of the members may be appointed from one political party; municipal officers may serve as members, ex officio, and the compensation of members other than ex officio members, is to be fixed by the Board of Estimate and paid by the authority. (3) The plants and facilities to be acquired or constructed are to cost not more than one billion dollars; are to be self-supporting after the first three years of operation; the maximum period of maturity of the authority's bonds is fifty years; rates for utility service must be sufficient to amortize the entire debt, pay interest thereon and all costs of operation, ownership and maintenance. (4) The city is authorized to acquire property for the authority at the authority's expense and may assign property to the authority. (5) Prior approval of the board of estimate and the planning commission are to be required before the plants and facilities may be constructed, thus preserving and protecting the master plan of the city. (6) Neither the city nor the state is to be liable upon the obligations of the authority. This bill would create the authority to purchase the Staten Island Edison Corp. which was a matter of controversy in the city council during the past few years.

•

Plan to Rebuild Boiler

Rebuilding of No. 1 boiler at the plant of the Saskatchewan Power Commission at Saskatoon, Canada, at a cost of $84,000 has been approved by the standing committee of the Saskatchewan City Council. Permission for the work has been received from the construction controller in Ottawa and it is planned to have the work completed in time for the peak load period in the late fall of 1944. It has been estimated that the rebuilding will save $5,500 in fuel a year, as well as $2,000 in maintenance costs, and will increase the steam capacity of the plant by 35,000 lb. per hour.

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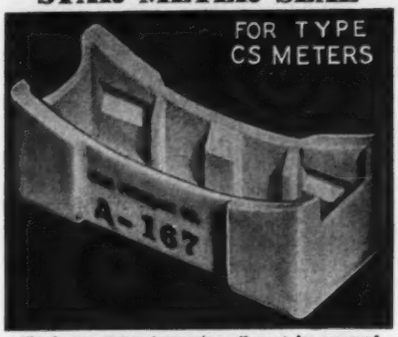

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Electron-Optics. By Dr. Paul Hatschek; translated by Arthur Palme. American Photographic Publishing Co., Boston, Mass. 161 pages, illustrated. Price $3.

Without recourse to mathematics, this translation explains the technique of beam deflection, focusing, electric-magnetic lenses and electron multipliers leading up to television and the electron microscope. A final chapter by the translator summarizes the developments since 1938.

Modern Turbines. By Louis E. Newman, Allen Keller, John M. Lyons and Lawrence B. Wales. John Wiley & Sons, Inc., New York. 175 pages, illustrated. Price $2.50.

This is a book about intelligent selection and application of utility and industrial turbines and in no sense a treatise on their design. Devoted primarily to units under 10,000 kw. it does, however, such a compact and terse job of establishing the potentialities and limitations of condensing, non-condensing, extraction and superposed turbines that even the well-versed operators of units several times as large can improve their grasp of performance aims and deviations. Above all, it could greatly help the utility power sales engineer to coach an industrial client so that he will be sure he knows what he is contemplating and, if the decision is to engage in generation, to do it in full appreciation of how much the unit can accomplish —in thermal and dollar economy.

The Practical Design of Welded Steel Structures. By H. Malcolm Priest. American Welding Society, 33 West 39th Street, New York 18, N. Y. 153 pages, illustrated. Price $1.

Presents a revision and extension of two major papers of the author in the A.W.S. Journal (April, 1942 and September, 1943) discussing forms of joints, temperature consequences, techniques for girders, columns, trusses, beams, continuous structures and rigid frames. A brief bibliography lists important codes and specifications.

Communication Circuits (2nd Edition). Lawrence A. Ware and Henry R. Reed. John Wiley & Sons, Inc. 330 pages, illustrated. $3.50.

Revision incorporates additional material on impedance matching, wave guides, choice of tube sizes, excitation and detection. Coupled with the first edition material on the theory of the transmission circuit, coaxial cables, networks, attenuation, reflection, filters, transformations, field configuration and propagation, one has the mathematical basis for optimum design of lines for frequencies from low to UHF. Thus the treatment is pertinent to induction-heating and dielectric-heating problems.

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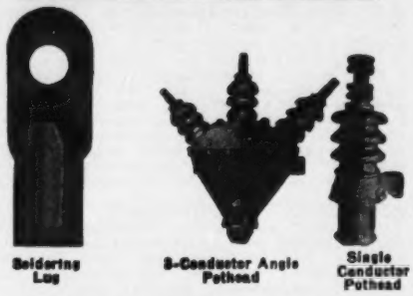

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SALES PROMOTION MAN wanted. Large mid-western electric utility want a Sales Promotion man experienced in the preparation of sales manuals, chart talks, and sales training. A knowledge of electrical merchandising will be helpful. Height, general appearance and public speaking ability must be above average. Maximum age 40. Splendid opportunity for the right man. In reply state age, training experience, general qualifications and salary expected. P-669, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

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(Continued on opposite page)

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If you are a young electrical engineer desiring to express your creative talents doing research and development work in a high voltage laboratory of a long established manufacturer who is searching for several technically trained men with electrical engineering degrees, write giving complete details including recent snap shot of yourself.

Your salary—?—that can be worked out at the time an interview is arranged.

P-649, Electrical World
330 West 42nd St., New York 18, N. Y.

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An executive assistant is wanted for the staff of a large mid-western electric utility for work in the fields of rates, forecasting, planning, regulation, cost analyses, depreciation, etc.

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Submit details of qualifications, war status, education, background and experience. Statement of availability required.

Our organization knows about this advertisement and all correspondence will be held confidential.

P-660, Electrical World
520 North Michigan Ave., Chicago 11, Ill.

WANTED

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A sound, well established electric public utility located in the middle west and having an annual gross revenue of approximately $8,000,000 has a vacancy as Secretary-Treasurer, which it is unable to fill from its own organization. Applications are invited, especially from those now occupying positions as Assistant Secretary-Treasurers or Comptroller of an electric public utility. Applications should give complete details of the applicant's education, training and experience, his age, marital, family and draft status and a snapshot photograph. Communications will be kept confidential, if desired. Reply to

P-668, Electrical World
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ENGINEERS

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Nationwide engineering organization has openings for well qualified electrical engineers experienced in design and the preparation of drawings for lighting and power distribution for industrial plant construction.

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D C MOTORS

	HP	Make	Type	Volts	Speed
2	1250	G.E.	MPC	550	130
1	800	G.E.	MPC	660	600
2	625	G.E.	MPC	500	130
1	600	G.E.	MPC	600	650/900
1	500	G.E.	MPC	230	900
1	350	G.E.	MPC	230	450
2	300	G.E.	DMC	230	400/600
1	300	G.E.	MPC	230	275/550
1	270	Whse.		550	250/400
1	250	Al. Ch.		230	525
2	200	Whse.		230	400
1	175	Whse.	SK	250	150/525
1	150	G.E.	RC-19A	230	800/1000
1	150	G.E.	MPC	230	250/450
2	125	G.E.	CO-1832	230	625
2	120	Whse.	SK-180	230	720
1	100	G.E.	LC-50	230	1200
1	100	Al. Ch.		230	950/1150
1	100	G.E.	MPC	230	225/450
2	100	G.E.	RC-19	230	575/720
1	75	G.E.	LC	230	500/1000
2	75	Whse.	SK-183	230	550/1100
1	60	El. Dy.	258	230	525/1050
2	50/60	Cr. Wh.	65H	230	500/1000
1	50	Cr. Wh.	CMC-81H	230	300/900
10	50	G.E.	RF-16	230	400/1600

TRANSFORMERS

	KVA	Make	PH Type	Voltages
6	1667	Pitts	1 OISC	13200x2300
1	1050	G.E.	3 WCTH	11000x445
1	600	G.E.	3 HT-OISC	11550x2200
3	333	Moloney	1 C-OISC	22000/11000x2300/575
2	333	Whse.	1 OISC	2300x460
1	333	Pitts.	1 OISC	2400x2-0
1	300	G.E.	1 H-RP	13200x575/1150/2300
1	300	Pitts.	3 ODSC	4150x208/120
1	300	Packard	1 OISC	2200x220/440
1	200	G.E.	1 H-LDD	26400x115/460
1	200	G.E.	1 H-OISC	2300x115/230

MOTOR GENERATOR SETS

3 ph. 60 cycle

1—1500 KW GE 275 V. Gen. d.c. to 2100 HP, 2300 V. Syn. Motor.
1—1000 KW Whse. 600 V. Gen. d.c. to 1400 HP 4000 V. Syn.
1—500 KW GE 600 V. DC Gen. d.c. to 700 HP—2200/13200 V. Syn. Motor with Exciter.
1—400 KW G. E. 250/275 V. Gen. to 700 HP ATI 440/2300/4000 V. Motor.
1—300 KW G. E. 250 V. Gen. to 400 KVA 440 V.
1—100 KW Whse. SK 250 V. Gen. to 150 HP Syn. 2300 V. 900 RPM motor with excit.
1—75 KW G. E. 125 V. Gen. to 120 HP IK 4000/2300 V. motor.

TURBO GENERATOR SET

1—500 KW, Whse. 625 Kva., 440 V., 3 ph., 60 cy., 3600 RPM with Parsons 145/175 lb. condensing turbine complete with jet condenser and accessories.

ROTARY CONVERTERS

60 cycle

	KW	Make	Speed	D.C. Volt	Trans. Volts
1	1500	Whse.	720	600	2300
1	1500	Whse.	600	600	11500
1	1250	G.E.	720	250	2300
1	1000	G.E.	900	600	13200
1	1000	Whse.	900	600	11000
1	750	G.E.	1200	600	2300
1	750	Whse.	720	250	6600/2300
1	500	Whse.	1200	600	13200/2300
1	375	G.E.	1200	250	6600/2300
3	300	G.E.	1200	600	2300

25 cycle

2	1500	G.E.	500	225/275	13200/6600
1	500	G.E.	750	225/275	13200/6600

All units can be furnished with AC and DC controls.

A. C. MOTORS

3 ph. 60 cycle

Synchronous

	HP	Make	Type	Volts	Speed
1	500	G.E.	TS	440	360
1	400	G.E.	ATI	440	720
1	225	G.E.	ATI	240	600
1	150	Al. Ch.		2300	900
1	150	Whse.		2200/550	1800
1	125	G.E.	ATI	220/440	900
2	100	Whse.	G	2200	1800
1	75	G.E.	TS-7556	220/440	600

Slip Ring

1	1200	Cr-Wh.	801-Q	2200	257
1	800	Whse.	CW	440	357
1	800	Al. Ch.		440	585
2	600	G.E.	IP	440/2200	720
1	450	Whse.	CW	2200	875
1	400	G.E.	IP	440/2200	600
1	400	Al. Ch.		2300	505
1	350	G.E.	IM	2300/4000	257
1	300	Whse.	CW	440	585
1	300	G.E.	IM	440	720
2	250	G.E.	MT	440	450
1	250	G.E.	MT	4000/2300	257
2	200	G.E.	IE-M	2200	1750
2	200	Whse.	CW	2200	514
1	200	G.E.	IM	440	600

Squirrel Cage

1	500	G.E.	1-17B	2200	695
1	400	Whse.	CS-1104A	2200	585
1	300	Whse.	CB	550	580
1	300	G.E.	IK	2300	600
1	250	Al. Ch.		220/440	1150

SYNCHRONOUS CONDENSERS

1	1000	G.E.	ATI	2200/3800	900
1	750	G.E.	ATI	220/440	900
1	600	G.E.	ATI	220/440	900

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MOTOR—3 PHASE 60 CYCLE

1—500 HP, 900 RPM, 440 volt, Lincoln slip ring
1—400 HP, 514 RPM, 440 volt, Westg., slip ring
1—335 HP, 600 RPM, 2300 volt, G.E. syn.
1—500 HP, 900 RPM, 440 volt, Lincoln slip ring.
1—250 HP, 514 RPM, 4000 volt, G.E., syn.
1—250 HP, 600 RPM, 4000 volt, G.E., sync.
1—200 HP, 600 RPM, 2200 volt, G.E., sl. rg.
1—200 HP, 450 RPM, 2200/4000 v. G.E., sl. rg.
1—150 HP, 1800 RPM, 440 volts, G.E., sq. cs.
1—150 HP, 900 RPM, 440 volt, Al. Ch. sl. rg.
2— 75 HP, 1200 RPM, 2300 volt, G.E., vertical

MOTORS—D. C. 230 VOLTS

2—450 HP, 400 RPM, General Electric MPL.
1—250 HP, 760 RPM, Electro Dynamic.
2—150 HP, 550 RPM, Westinghouse, SK.
1—150 HP, 750 RPM, Electro Dynamic.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, 625 RPM, G.E.
1— 80 HP, Crocker-Wheeler, 600 RPM.
1— 75 HP, 950 RPM, General Electric
1— 50 HP, RPM, Westinghouse, type SK.

TRANSFORMERS

2—400 KVA, G.E., 4156-240/480 v. Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
2—200 KVA, G.E., 2200-220/440 volts.
2—200 KVA, Allis-Chalmers, 2200/220/440
3—150 KVA, G.E., 33,000 2300/4000 Y.
3—100 KVA, Westinghouse, 11,430/250 volts
3—100 KVA, G.E., 2200-220/110 volts.
1—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
3—100 KVA, Westinghouse, 13200 250 volts.
3—100 KVA, Allis-Chalmers, 2200/220/110
3—100 KVA, Allis-Chalmers, 2400/4150Y-2400
3— 75 KVA, General Electric 2200/220/440.

MOTORS GENERATOR SETS

1—750 KW, 250 volt, Allis-Chalmers, synchronous.
1— 75 KW, 125 volt, General Electric, squirrel cage.
1— 6 KW, 125 volt, General Electric, squirrel cage.

MOTORS—VARIABLE SPEED 230 VOLTS

1—100 HP, 475/1425 RPM, Electro Dynamic
1— 90 HP, 470/940 RPM, General Electric.
1— 75 HP, 525/1575 RPM, Electric Dynamic.
1— 35 HP, 500/1500 RPM, Westinghouse.
1— 35 HP, 350/1050 RPM, Electric Dynamic.
1— 30 HP, 225/900 RPM, Crocker-Wheeler.
2— 25 HP, 300/900 RPM, Electro Dynamic.
1— 20 HP, 750/1500 RPM, General Electric.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker-Wheeler.

ALTERNATORS

1—625 KVA, 3600 RPM, 600 volt, G.E.
1—250 KVA, 720 RPM, 230 volt, G.E.
1—225 KVA, 514 RPM, 600 volt, Westinghouse.
1—200 KVA, 3600 RPM, 240 volt, Allis-Chalmers.
1—62½ KVA, 3600 RPM, 220 volt, Allis-Chalmers.

TURBO-GENERATORS

600 KW, Terry dual bleeder condensing Turbine only.
1—500 KW, G.E., 3 ph., 60 cy., 480 volt, bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 volt, cond.

ENGINE GENERATOR SETS

1—150 KVA, General Electric Generator, Ames Uniflow engine.
1—62½ KVA, Westinghouse Generator. Fairbanks company engine.

Complete Line of A.C. and D.C. Motors and Generators

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(Continued from opposite page)

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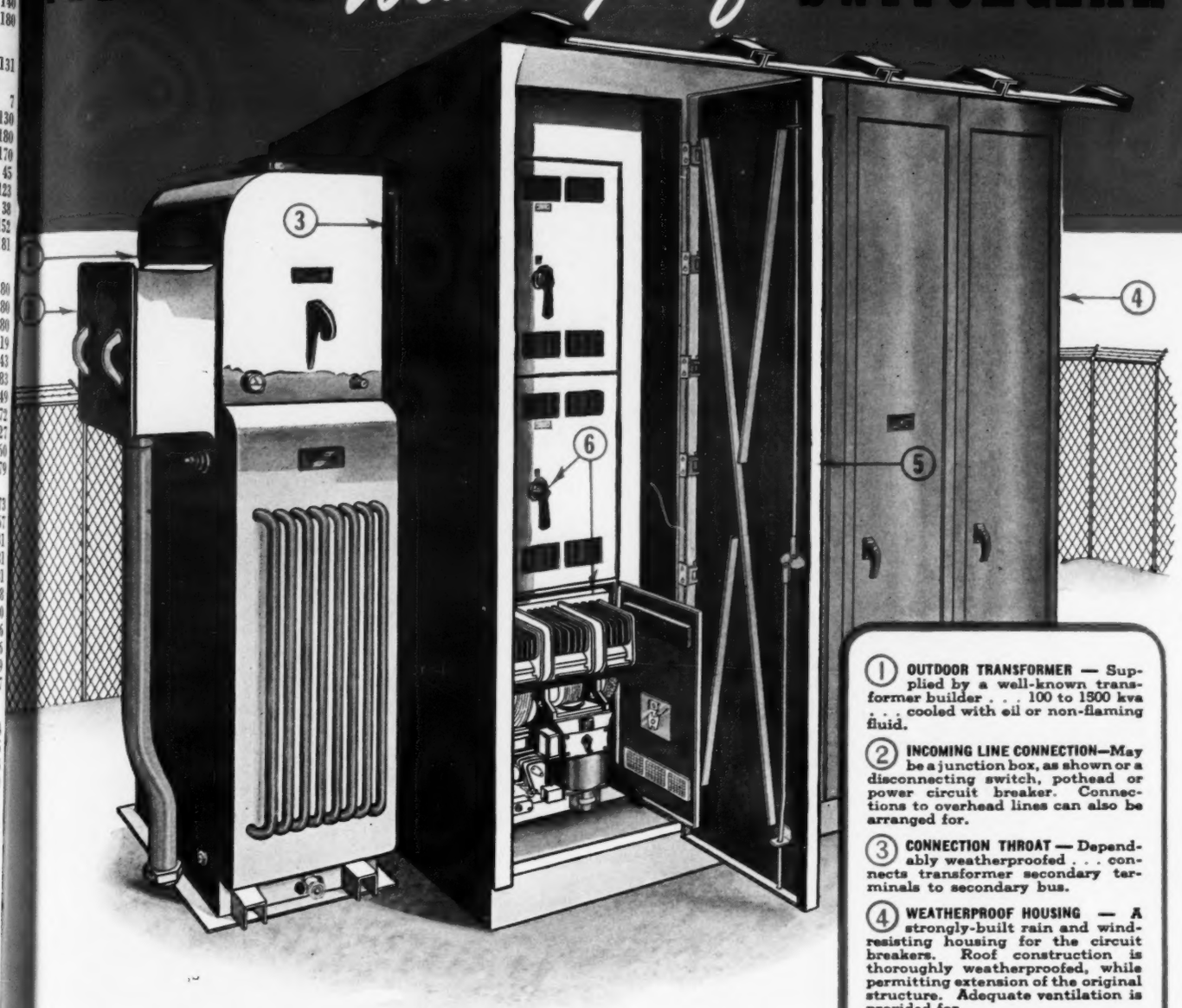
★ **These companies have supplied additional buying information on their products in the 1944 edition of the Electrical Buyers' Reference**

NVESTIGATE THE POSSIBLE SAVINGS WITH I-T-E *Weatherproof* SWITCHGEAR



(1) **OUTDOOR TRANSFORMER** — Supplied by a well-known transformer builder . . . 100 to 1500 kva . . . cooled with oil or non-flaming fluid.

(2) **INCOMING LINE CONNECTION**—May be a junction box, as shown or a disconnecting switch, pothead or power circuit breaker. Connections to overhead lines can also be arranged for.

(3) **CONNECTION THROAT** — Dependably weatherproofed . . . connects transformer secondary terminals to secondary bus.

(4) **WEATHERPROOF HOUSING** — A strongly-built rain and wind-resisting housing for the circuit breakers. Roof construction is thoroughly weatherproofed, while permitting extension of the original structure. Adequate ventilation is provided for.

(5) **FULL-LENGTH DOORS** — Three-point latches, stiffening braces, flanged edges and concealed adjustable hinges are furnished. Provision can be made for locking the doors when closed.

(6) **CIRCUIT BREAKERS** — Drawout type, manually or electrically operated . . . current and interrupting rating to suit your requirements. Each breaker is protected by a hinged door with ventilating louvers and may be operated manually without opening door. In capacities up to 1600 amperes, the circuit breakers are mounted three-high as shown. A wide range of protective devices is available to guard against overcurrent, short circuits, low voltage and other abnormal conditions.

No brick and mortar structure to build, since I-T-E Weatherproof Switchgear can safely be placed anywhere outdoors. By choosing a location close to the plant area where power is used, cables for low-voltage current can be short. These are savings. Add to them the provisions I-T-E makes for long service life under outdoor conditions—tightness of welded-steel structures, the protection qualities of I-T-E finish, the durable circuit breakers capable of performing with minimum of maintenance. Let I-T-E engineers give you the cost figures of outdoor substations in accordance with your specifications.

Representatives in Principal Cities

I-T-E

AIR SWITCHGEAR

IMMERSED IN AIR — ENCASED IN STEEL

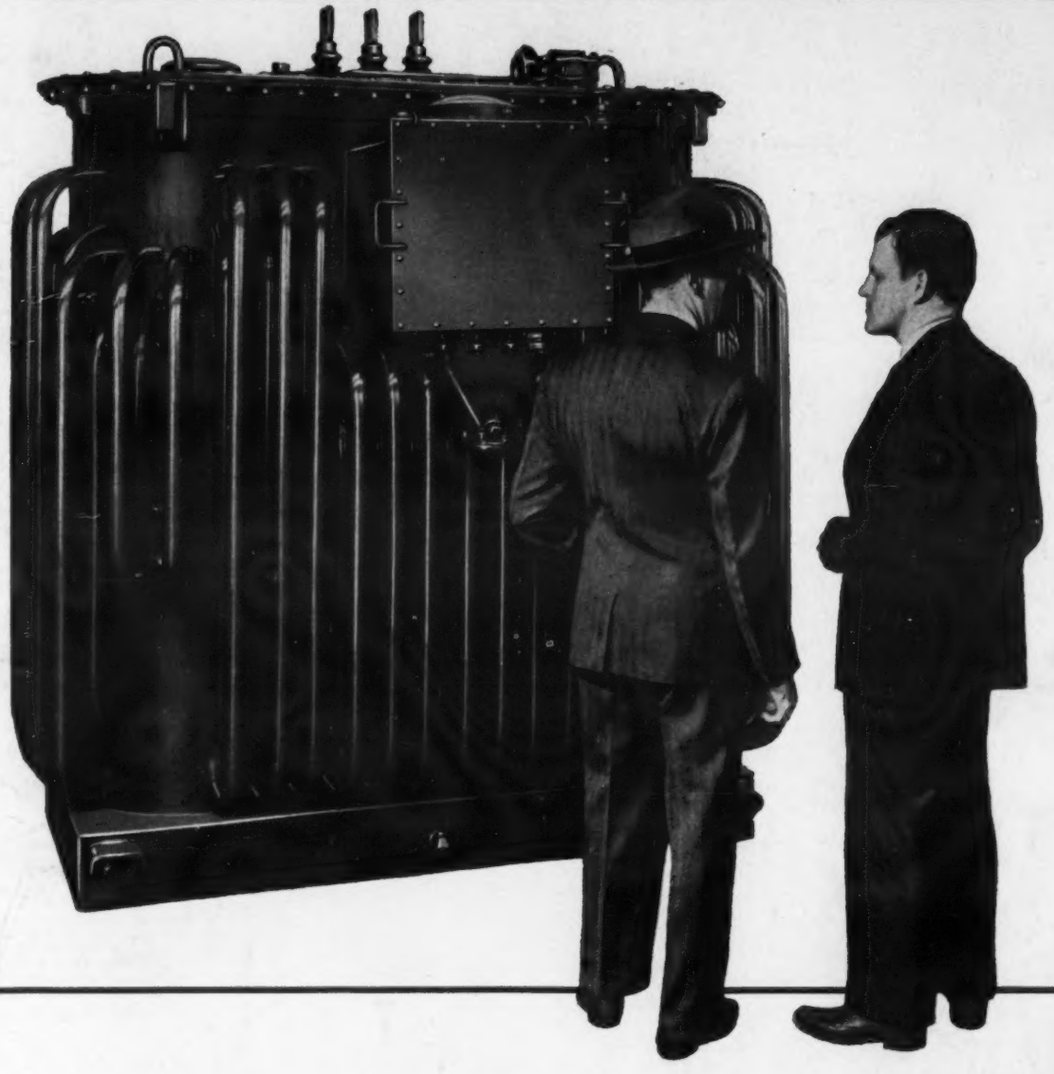
ARMY E NAVY

The Army-Navy "E" for Production Excellence

I-T-E

CIRCUIT BREAKER CO., PHILADELPHIA 30, PA.

"...and the cooling fluid makes it a honey from the standpoint of maintenance"



Why Kuhlman SAF-T-KUHL POWER TRANSFORMERS are the choice of so many experienced engineers . . .

Filled with a non-inflammable, non-explosive, inert cooling fluid, Kuhlman Saf-T-Kuhl Transformers are 100% safe.

They eliminate the need of expensive vaults. They improve voltage regulation. Small Saf-T-Kuhl Distribution Transformers can be installed at the load center—even on beams near the ceiling. Saf-T-Kuhl Power Transformers are built in a variety of sizes and capacities to meet the installation requirements. The unit shown here is a 1000 KVA, 60 cycle, three-phase, 13,800-240 volts with taps. Primary outlets are through the junction box and pothead. Equipment includes current transformer, external tap changer, relief diaphragm, hot spot indicator, liquid gauge and dial thermometer.

In addition to Saf-T-Kuhl, Kuhlman builds Power, Distribution and CSP Transformers and Line Regulators. When you need transformers it will pay you to specify Kuhlman.

Kuhlman

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